WASHINGTON STATE PATROL

Latent Prints Technical Manual

CRIME LABORATORY DIVISION

February 2015

1.0 SCOPE

This Latent Prints Technical Procedures Manual is a living document that can be reviewed and updated at any time as deemed necessary by the Latent Prints Technical Working Group. Any update to this manual must then be approved by the Washington State Patrol (WSP) Crime Laboratory Division Director and Quality Assurance Manager.

This document defines both the technical procedures for processing the majority of evidence encountered by the latent print discipline and individualization of resulting impressions.

1.1 GOALS

- Describe methods for developing friction ridge impressions on various surface types
- Describe a method for friction ridge examinations and the basis for conclusions

1.2 OBJECTIVES

- Establish principles and procedures for the processing of latent print evidence
- Establish principles by which latent print examinations are conducted
- Establish a method for latent print examination
- Establish the conclusions that may result from an examination

2.0 REFERENCES

- WSP Regulations Manual
- WSP Crime Laboratory Division (CLD) Chemical Hygiene Plan
- WSP CLD Safety and Wellness Plan
- WSP CLD Forensic Services Guide
- WSP CLD Operations Manual
- WSP CLD Quality Manual
- Safety Guidelines, International Association for Identification
- Manual of Fingerprint Development Techniques, Home Office Scientific Research and Development Branch, 1992
- Accreditation Manual, American Society of Crime Laboratory Directors (ASCLD)
- Chemical Formulas & Processing Guide for Developing Latent Prints, U.S. Department of Justice, FBI
- SWGFAST Guidelines, Scientific Working Group on Friction Ridge Analysis, Study, & Technology, 1999

3.0 TERMS AND DEFINITIONS

ACE-V:

The acronym for a scientific method; Analysis, Comparison, Evaluation, and Verification (see individual terms).

AFIS

The acronym for Automated Fingerprint Identification System, a generic term for a finger/palm print matching, storage, and retrieval system.

Alternate light Source (ALS):

Any light source, other than a laser, used to excite luminescence of latent prints, body fluids, etc.

Analysis:

The first step of the ACE-V method. The assessment of an impression to determine suitability for comparison.

Anatomical Source:

An area of friction ridge skin from an individual from which an impression originated.

Arch – Plain

A pattern type in which the friction ridges enter on one side of the impression and flow, or tend to flow, out the other side with a rise or wave in the center.

Arch – tented

A pattern type that possesses either an angle, an upthrust, or two of the three basic characteristics of the loop.

Artifact

Any distortion or alteration not in the original friction ridge impression, produced by an external agent or action.

1. Any information not present in the original object or image, inadvertently introduced by image capture, processing, compressions, transmission, display, or printing.

Bias

See cognitive bias, confirmation bias, and contextual bias.

Bifurcation

The point at which one friction ridge divides into two friction ridges.

Blind Verification

The independent examination of one or more friction ridge impressions at any stage of the ACE process by another competent examiner who is provided with no, or limited, contextual information, and has no expectation or knowledge of the determinations or conclusions of the original examiner.

Bridge

A connecting friction ridge between, and generally at right angles to, parallel running friction ridges.

Candidate:

An individual's finger/palm print record under consideration for comparison to the latent finger/palm print.

Characteristic:

Distinctive details of the friction ridges, including Level 1, 2, and 3 details (also known as features).

Cognitive Bias:

The effect of perceptual or mental processes on the reliability and validity of one's observations and conclusions.

Clarity:

Visual quality of a friction ridge impression

Comparison:

The second step of the ACE-V method. The observation of two or more impressions to determine the existence of discrepancies, dissimilarities, or similarities.

Competency:

Possessing and demonstrating the requisite knowledge, skills, and abilities to successfully perform a specific task.

Complete friction ridge exemplars:

A systematic recording of all friction ridge detail appearing on the palmar sides of the hands. This includes the extreme sides of the palms, joints, tips, and sides of the fingers (also known as major case prints).

Complex examinations:

The encountering of uncommon circumstances during an examination (e.g., the existence of high distortion, low quality or quantity, the possibility of simultaneity, or conflicts among examiners).

Consensus determination or conclusion:

Agreement reflecting the collective judgment of a group of examiners trained to competency when making determinations or conclusions with respect to one or more impressions.

Conclusion:

Determination made during the evaluation stage of ACE-V, including individualization, inconclusive, exclusion.

Confirmation Bias:

The tendency to search for data or interpret information in a manner that supports one's preconceptions.

Conflict:

A difference of determinations or conclusions that becomes apparent during, or at the end of, an examination.

Consultation:

A significant interaction between examiners regarding one or more impressions in question.

Contextual Bias:

The effect of information or outside influences on the evaluation and interpretation of data.

Control:

A known standard or preparation for checking or verifying a test reagent.

Core:

1. The approximate center of a fingerprint pattern.
2. A specific formation within a fingerprint pattern, defined by classification systems such as Henry.

Delta:

The point on a friction ridge at or nearest to the point of divergence of two type lines, and located at or directly in front of the point of divergence. Also known as a tri-radius.

Deviation:

1. A change in friction ridge path.
2. An alteration or departure from a documented policy or standard procedure.

Discrepancy:

The presence of friction ridge detail in one impression that does not exist in the corresponding area of another impression (compare with dissimilarity).

Dissimilarity:

A difference in appearance between two friction ridge impressions (compare with discrepancy).

Dissociated ridges:

1. Disrupted, rather than continuous, friction ridges.

2. An area of friction ridge units that did not form into friction ridges, generally due to a genetic abnormality.

Distortion:

Variances in the reproduction of friction skin caused by factors such as pressure, movement, force, and contact surface.

Dot:

An isolated friction ridge unit whose length approximates its width in size.

Edgeoscopy:

1. Study of the morphological characteristics of friction ridges.
2. Contour or shape of the edges of friction ridges.

Elasticity:

The ability of skin to recover from stretching, compression, or distortion

Elimination prints:

Exemplars of friction ridge skin detail of persons known to have had legitimate access to an object or location.

Enclosure:

A single friction ridge that bifurcates and rejoins after a short course and continues as a single friction ridge.

Ending ridge:

A single friction ridge that terminates within the friction ridge structure.

Erroneous exclusion:

The incorrect determination that two areas of friction ridge impressions did not originate from the same source.

Erroneous individualization:

The incorrect determination that two areas of friction ridge impressions originated from the same source.

Evaluation:

The third step of the ACE-V method wherein an examiner assesses the value of the details observed during the analysis and the comparison steps and reaches a conclusion.

Exclusion:

The determination by an examiner that there is sufficient quality and quantity of detail in disagreement to conclude that two areas of friction ridge impressions did not originate from the same source.

Exemplars:

The prints of an individual, associated with a known or claimed identity, and deliberately recorded electronically, by ink, or by another medium (also known as known prints).

Features:

Distinctive details of the friction ridges, including Level 1, 2, and 3 details (also known as characteristics).

Fingerprint:

An impression of the friction ridges of all or any part of the finger

Focal Points:

1. In classification, the core(s) and the delta(s) of a fingerprint.

2. Another term for target group.

Forensic Light Source:

See Alternate Light Source.

Friction Ridge:

A raised portion of the epidermis on the palmar or plantar skin, consisting of one or more connected ridge units.

Friction Ridge Detail (Morphology):

An area comprised of the combination of ridge flow, ridge characteristics, and ridge structure

Friction ridge unit:

A single section of ridge containing one pore.

Furrows:

Valleys or depressions between friction ridges.

Galton details:

Term referring to friction ridge characteristics (also known as minutiae) attributed to the research of English fingerprint pioneer, Sir Francis Galton.

Ground truth:

Definitive knowledge of the actual source of an impression.

Henry Classification:

An alpha-numeric system of fingerprint classification named after Sir Edward Richard Henry used for filing, searching, and retrieving tenprint records.

IAFIS:

The acronym for Integrated Automated Fingerprint Identification System, the FBI's national AFIS.

Identification:

1. See individualization.
2. In some forensic disciplines, this term denotes the similarity of class characteristics.

Impression:

Friction ridge detail deposited on a surface.

Incipient ridge:

A friction ridge not fully developed that may appear shorter and thinner than fully developed friction ridges.

Inconclusive:

The determination by an examiner that there is neither sufficient agreement to individualize, nor sufficient disagreement to exclude.

Individualization:

The determination by an examiner that there is sufficient quality and quantity of detail in agreement to conclude that two friction ridge impressions originated from the same source.

Joint (of the finger):

The hinged area that separates segments of the finger.

Known prints (finger, palm, foot):

The prints of an individual, associated with a known or claimed identity, and deliberately recorded electronically, by ink, or by another medium (also known as exemplars).

Latent Print:

1. Transferred impression of friction ridge detail not readily visible.

Generic term used for unintentionally deposited friction ridge detail.

Level 1 detail:

Friction ridge flow, pattern type, and general morphological information.

Level 2 detail:

Individual friction ridge paths and associated events, including minutiae.

Level 3 detail:

Friction ridge dimensional attributes, such as width, edge shapes, and pores.

Lift:

An adhesive or other medium used to transfer a friction ridge impression from a substrate.

Live Scan:

Electronic recording of friction ridges

Loop:

A pattern type in which one or more friction ridges enter upon one side, recurve, touch or pass an imaginary line between delta and core and flow out, or tend to flow out, on the same side the friction ridges entered. Types include left slant loops, in which the pattern flows to the left in the impression; right slant loops, in which the pattern flows to the right in the impression; radial loops, in which the pattern flows in the direction of the radius bone of the forearm (toward the thumb); and ulnar loops, in which the pattern flows in the direction of the ulna bone of the forearm (toward the little finger).

Major Case Print:

A systematic recording of the friction ridge detail appearing on the palmar sides of the hands. This includes the extreme sides of the palms, joints, tips, and sides of the fingers (also known as complete friction ridge exemplars).

Mated Impressions:

Impressions intentionally collected to originate from the same source, and used for the purpose of measuring error rates.

Matrix:

The substance that is deposited or removed by the friction ridge skin when making an impression.

Minutiae:

Events along a ridge path, including bifurcations, ending ridges, and dots (also known as Galton details).

Missed exclusion:

The failure to make an exclusion when in fact the friction ridge impressions are non-mated (includes false positive, non-consensus inconclusive and non-consensus no value).

Missed Individualization:

The failure to make an individualization when in fact both friction ridge impressions are mated (includes false negative, non-consensus inconclusive and non-consensus no value).

Non-complex:

The encountering of common circumstances during an examination (e.g., low distortion, high quality or quantity, or no conflicts among examiners).

Non-consensus determination of no value:

Decisions of no value that conflict with the consensus.

Non-consensus determination of suitability:

When an examiner's determination of suitability does not concur with consensus. Suitability determinations include non-consensus no value, and non-consensus value decisions.

Non-consensus determination of value:

Decisions of value that conflict with the consensus.

Non-consensus exclusion conclusion:

When an examiner reaches a decision of exclusion that conflicts with the consensus, exclusive of false negative errors.

Non-consensus inconclusive:

When an examiner reaches a decision of inconclusive that conflicts with the consensus, exclusive of false positive and negative errors.

Non-consensus individualization conclusion:

When an examiner reaches a decision of individualization that conflicts with the consensus, exclusive of false positive errors.

Non-mated impressions:

Impressions intentionally collected to originate from different sources, and used for the purpose of measuring error rates.

Original image:

An accurate replica (pixel for pixel) of the primary image.

Palmprint:

An impression of the friction ridges of all or any part of the palmar surface of the hand.

Patent Print:

Friction ridge impression of unknown origin, visible without development.

Pattern classification:

Sub-division of pattern type, defined by classification systems such as Henry or National Crime Information Center (NCIC) classifications.

Pattern type:

Fundamental pattern of the ridge flow: arch, loop, whorl. Arches are subdivided into plain and tented arches; loops are subdivided into radial and ulnar loops; whorls are subdivided into plain whorls, double loops, pocket loops, and accidental whorls.

Phalanx/Phalange:

1. A bone of the finger or toe.
2. Sometimes used to refer to a segment of a finger.

Plastic Print:

Friction ridge impression of unknown origin that is impressed in a soft substrate to create a three-dimensional impression.

Pores:

Small openings in the skin through which perspiration is released.

Poroscopy:

A study of the size, shape, and arrangement of pores.

Preserved Impression:

Casting, photography, lifting, or other method used to capture a latent impression for further examination.

Primary Image:

The first recording of an image onto media.

Proficiency:

The ongoing demonstration of competency.

Quality:

The clarity of information contained within a friction ridge impression.

Quantity:

The amount of information contained within a friction ridge impression.

Reagent:

Substance used in a chemical reaction to detect, examine, measure, or produce other substances.

Relative Position:

Proximity of characteristics to each other

Ridge flow:

1. The direction of one or more friction ridges.
2. A component of Level 1 detail.

Ridge Path:

1. The course of a single friction ridge.
2. A component of Level 2 detail.

Ridge unit:

See friction ridge unit.

Ridgeology:

The study of the uniqueness of friction ridge skin and its use for personal identification.

Segment (of the finger):

The proximal, medial, or distal section of the finger.

Short ridge:

A single friction ridge beginning, traveling a short distance, and then ending.

Simultaneous impression:

Two or more friction ridge impressions from the same hand or foot deposited concurrently.

Source:

An area of friction ridge skin from an individual from which an impression originated.

Spur:

A bifurcation with one short friction ridge branching off a longer friction ridge.

Stand-alone:

A segment of a simultaneous impression that has sufficient information to arrive at a conclusion of individualization independent of other impressions within the aggregate.

Stock Solution:

Concentrated solution diluted to prepare a working solution.

Substrate:

The surface upon which a friction ridge impression is deposited.

Sufficiency:

The product of the quality and quantity of the objective data under observation (e.g., friction ridge, crease, and scar features).

Sufficient:

The determination that there is sufficiency in a comparison to reach a conclusion at the evaluation stage.

Suitable:

The determination that there is sufficiency in an impression to be of value for further analysis or comparison.

Target group:

A distinctive group of ridge features (and their relationships) that can be recognized.

Tenprint:

1. A generic reference to examinations performed on intentionally recorded friction ridge impressions.

2. A controlled recording of an individual's available fingers using ink, electronic imaging, or other medium.

Tolerance:

The amount of variation in appearance of friction ridge features to be allowed during a comparison, should a corresponding print be made available.

Trifurcation:

The point at which one friction ridge divides into three friction ridges.

Type lines:

The two innermost friction ridges associated with a delta that parallel, diverge, and surround or tend to surround the pattern area.

Verification:

The independent application of the ACE process as utilized by a subsequent examiner to either support or refute the conclusions of the original examiner; this may be conducted as blind verification. Verification may be followed by some level of review as specified by agency policy. Confirmation of an examiner's conclusion by another qualified examiner

Whorl – accidental:

1. A pattern type consisting of the combination of two different types of patterns (excluding the plain arch) with two or more deltas.

2. A pattern type that possesses some of the requirements for two or more different types of patterns.

3. A pattern type that conforms to none of the definitions of a pattern.

Whorl – central pocket loop:

A pattern type that has two deltas and at least one friction ridge that makes, or tends to make, one complete circuit, which may be spiral, oval, circular, or any variant of a circle. An imaginary line drawn between the two deltas must not touch or cross any recurving friction ridges within the inner pattern area.

Whorl – double loop:

A pattern type that consists of two separate loop formations with two separate and distinct sets of shoulders and two deltas.

Whorl – plain:

A fingerprint pattern type that consists of one or more friction ridges that make, or tends to make, a complete circuit, with two deltas, between which, when an imaginary line is drawn, at least one recurving friction ridge within the inner pattern area is cut or touched.

Working Solution:

Solution at the proper dilution for processing.

4.0 RESPONSIBILITIES

The Crime Laboratory Division's Quality Assurance Manager is overall responsible for ensuring that personnel adhere to established technical procedures and safety practices.

The Latent Prints Technical Leader and individual Latent Print Examiners are responsible for adhering to established technical procedures and safety guidelines.

Individual examiners shall be responsible for labeling and dating all chemicals used in the processing of latent print evidence.

The Latent Prints Laboratory Safety Officer or the Laboratory Manager shall be responsible for receiving and inventorying chemicals and updating the chemical inventory list.

The Crime Laboratory Division Safety Manager and Laboratory Safety Officers shall be responsible for the adherence by discipline personnel to all safety policies outlined herein and maintaining the Material Safety Data Sheets (MSDS) for all chemicals maintained in the discipline.

Fingerprint processing is a qualitative method and Uncertainty of Measurement does not apply.

4.1 NON-CONFORMING WORK

Any lab staff member who becomes aware of an erroneous identification that has been sent for official review will report the nonconformance to the supervisor. The supervisor will determine if the erroneous identification is clerical or technical in nature. All erroneous identifications that are technical in nature will be classified as Level I Nonconformity (see CLD Quality Manual, 3.0.3.2 Evaluation of the Significance of Nonconforming Work).

A missed identification is generally considered Level II Nonconformity and may be returned for correction once noted on the Technical/Administrative Review Tracking Sheet. The supervisor will monitor the Technical/Administrative Review Tracking Sheets to see if a pattern of missed identifications is developing with any scientist. If any scientist becomes aware of a missed identification that might be the result of gross negligence or incompetence, the supervisor will be notified. Recurring missed identifications and/or those that are the result of gross negligence or incompetence will be classified as Level I Nonconformity.

5.0 PHYSICAL EVIDENCE EXAMINATION

5.1 SCOPE

The primary purpose of these procedures is to ensure quality and efficiency by establishing documentation and collection procedures that will be utilized by the Latent Prints Laboratory.

Written technical procedures will be available in the Latent Prints Laboratory describing examination protocols for each category of latent print evidence that is routinely examined.

The assigned examiner of an evidence item is primarily responsible for the preservation and possible collection of evidentiary materials that may be on that item. While the assigned scientist is primarily responsible for the detection and preservation of friction ridge skin impressions, the scientist must also remain cognizant of other probative evidence which may be presented on each item.

Friction ridge skin impressions can sometimes be destroyed by contact with other items. Items being submitted for examination must be handled as little as possible to minimize loss of the friction ridge skin evidence. Evidence items should be processed as soon as possible and not left for environmental destruction.

This manual will describe the methods, procedures and techniques that are routinely used in the examination of evidence. The procedures cannot be expected to address each and every situation or type of evidence encountered. The scientist will be given flexibility to determine an appropriate course of action in regard to the processes employed in the detection and preservation of friction ridge skin impressions; therefore, the procedures will be designed to accommodate the majority of evidence encountered.

The procedures presented are to be used in conjunction with all applicable laboratory policies, good laboratory practice, and proper scientific methodology.

Only the procedures, formulas and/or processes that are found in this manual, the U.S. Department of Justice, FBI, “Chemical Formulas and Processing Guide for Developing Latent Prints” and the Home Office, SRDB, “The Manual of Fingerprint Development Techniques” are approved for use in the Latent Prints Laboratory. All other procedures, formulas and/or processes not outlined in these manuals must be validated as per the Operation Manual Chapter 2. 2.10. (See also the SWGFAST Validation Recommendations, Appendices A, B and C).

5.2 BACKGROUND

The chemical composition of latent print residue is such that chemical techniques can be used effectively to process impressions on most porous surfaces, as well as most non-porous surfaces.

1. The eccrine, or sweat, glands on the human body are most concentrated on the palmar surfaces of the hands and the plantar surfaces of the feet. Secretions from the eccrine glands consist of 99.0 to 99.5 percent water and 0.5 to 1.0 percent solids. The solids consist of about one-half organic substances and one-half inorganic salts. Sodium chloride is the most prevalent salt present and of the organic substances present, alpha-amino acids are important for latent print chemical processing purposes.

2. The oils and fats that may be present in latent print residue are primarily the result of sebum secreted by the sebaceous glands. Sebaceous glands are most

concentrated on the face and other areas, but are not present on the palmar surfaces of the hands or the plantar surfaces of the feet. The oily and fatty deposits present in latent print residue are generally the result of contaminants present on the hands from contact with other areas of the body. Slight contamination of the palmar surfaces with oils and fats naturally occurs by the flow of sebum from the forearms and dorsal surface of the hands to the palms.

Latent prints can be divided into two categories:

Invisible prints - those made by perspiration and other substances on the skin surface and which require development by physical or chemical methods.

Visible prints: Plastic/Patent - those made in soft pliable substances such as putty, modeling clay, etc (Plastic), and those made by contamination of the skin with such substances as blood, paint, ink, etc (Patent).

5.3 RELATED DOCUMENTS

- ADAMS User Manual
- CLD Operations Manual
- CLD Quality Manual
- Chemical Formulas & Processing Guide for Developing Latent Prints, U.S. Department of Justice, FBI
- FLSB Forensic Services Guide
- FLSB Safety Manual
- Home Office Manual of Fingerprint Development Techniques
- LIMS Manual
- Latent Prints Processing Worksheet
- SWGDE & SWGIT Digital & Multimedia Evidence Glossary (v. 2.2, 11/107)
- SWGFAST Digital Imaging Guidelines

5.4 SAFETY

All Latent Prints Laboratory personnel are advised to utilize appropriate safe work practices when handling the chemicals and solvents used in latent print technical procedures.

Safe work practices include:

- Wearing personal protective equipment such as gloves, laboratory coat, eye protection, etc. when handling any chemicals
- Making sure that all engineering controls such as ventilation hoods, chemical storage cabinets, etc. are used properly
- Utilizing clean work habits such as washing hands after the preparation of chemical solutions (even though gloved), no eating or drinking in chemical processing areas, etc. during daily work procedures

Specific safety practices regarding personal protective equipment and work practice controls are outlined within each processing technique described in Appendix B in this manual.

Safety practices regarding engineering controls, biohazards, the disposal of chemicals, etc. are outlined in the WSP Crime Laboratory Safety and Wellness Plan, IAI Safety Guidelines, and/or the WSP CLD MSDS library(s).

6.0 PROCESSING PROCEDURES

6.1 EVIDENCE EXAMINATION

A description of the evidence item(s) as well as all examinations, pertinent observations, and results shall be documented in the examiner's case notes.

Any item containing material which may be a controlled substance that is not sealed will be documented in the case file. The material will be weighed upon first recognition in its immediate package, without the evidence container. The mass may be truncated in documentation by dropping the least significant figure(s). Weights of residues and samples that cannot be accurately weighed may be estimated based on the sample's appearance, such as "residue", "trace", "much less than 0.1 gram" or similar language. Volumes of liquids should be measured or estimated as is practical. Tablets, capsules, injection vials and other such items should be counted when practical, or a total count should be estimated, or a weight of the items may be obtained.

Examine each item for visible friction ridge skin impressions as well as other probative evidence. If other types of evidence are observed, a notation regarding what was observed and how it was preserved for further analysis will be made.

A visual examination shall follow each technique employed. Some techniques may require the use of an alternate light source for examination. Impressions that are suitable for further analysis shall be preserved once detected and also if enhanced in any way by subsequent techniques.

6.2 PROCESSING SEQUENCES

Record the sequential order of the processing techniques used. If the evidence is not processed in accordance with the following general processing sequence guidelines, document the variance. The examiner may at any time make a determination that an item has been tested to its full potential.

Throughout the sequence of processing, any impressions deemed suitable for further analysis will be given an impression number and preserved prior to any additional processing techniques. Case notes shall indicate which lifts and/or images contain the latent print designator.

Plan an approach to process the evidence for latent prints. The scientist shall make the following considerations in determining the processing sequence for each item:

1. Generally, move from the least invasive technique to the most invasive technique.

2. Consider the surface of the item (porous, semi-porous, or non-porous) to establish suitable processing techniques.

3. Consider the color of the surface to determine which technique will provide suitable contrast for the detection of impressions.

4. Consider the texture of the surface to determine whether developed impressions will require imaging for preservation. In such a case, use a technique that will provide the best contrast.

5. Consider which matrix (sweat, blood, dirt, oil, amino acids, lipids, etc) may have been deposited or will best be developed on the surface of the item.

6. Avoid techniques which may compromise other forensic analyses which may be required.

The aforementioned considerations will work in conjunction with the following general processing sequence guidelines to allow the scientist the flexibility to determine the best course of action:

Porous Surfaces: substrates that absorb the latent print (i.e. paper, untreated wood, cardboard)

1. Visual examination
2. DFO, 1,2-indanedione, or 1,2-indanedione+zinc chloride
3. Ninhydrin
4. Physical Developer
5. Silver Nitrate

Semi-Porous Surfaces (i.e. some treated wood or cardboard)

1. Visual examination
2. Cyanoacrylate
3. Powder processing
4. DFO and/or Ninhydrin

Non-Porous Surfaces: substrates that do not absorb the latent print, (i.e. glass, metal, plastic)

1. Visual examination
2. Cyanoacrylate
3. Powder processing and/or dye stain (not necessarily in order)

If possibly contaminated with blood, use Amido Black or Acid Yellow 7 after processing the surrounding surfaces with powder.

Adhesive Surfaces (i.e. tape, stamps)

1. Visual examination
2. Gentian violet, powder suspension, or dye stain

Process the non-adhesive side of an item independently.

All reagents require the successful completion of a control prior to use. Each control test, whether positive or negative, must be noted in the scientist's case notes.

Items with Biological Contaminants

In general, the item may be visually examined, fumed with cyanoacrylate, and dusted with a clean powder prior to forwarding the evidence to the DNA section. Developed impressions should be imaged and not lifted if an item is pending DNA analysis. Chemical reagents or techniques that require a wash may be completed after the biological evidence has been collected. If needed, consult with the appropriate regional DNA section to determine sequencing order for any item possibly contaminated with blood or other biological contaminants.

6.3 DOCUMENTATION

Friction ridge skin impressions deemed to be suitable for further analysis may be preserved either by imaging or lifting. Each image and lift shall be given a unique identifying number. Case notes will indicate which impression numbers are represented in each image and lift.

Mark the evidence with the lab case number and scientist's initials. Impression numbers may also be marked on the evidence where obtained. If the evidence is too small to label, it may be placed in a package with the lab case number and scientist's initials before being returned to the original package.

6.4 PROCESSING TECHNIQUES

6.4.1 ACID YELLOW 7

Acid Yellow 7 is a fluorescent dye that stains bloody prints to give a yellow colored product. This technique is used to develop bloody latent prints on dark, non-porous surfaces.

Control Test

Deposit blood onto white poster board or similar medium of choice and process with Acid Yellow. A positive test will result in a developed control print in contrast to the background color when viewed with the alternate light source.

Procedure

The prints must be fixed prior to staining by using a 2% solution of sulfosalicylic acid in water. Hold a dry piece of absorbent paper over the print area and drop one edge to the surface of the solution. Working from the wet edge, progressively wet the paper while smoothing onto the print area. When completely covered, leave the wet paper on for at least three minutes. Apply the staining solution using a pipette or immersion. Leave the stain in contact with the print area for one-three minutes, then wash with the wash solution.

Examine the evidence under the alternate light source at 400nm-495nm using a yellow or light orange filter.

Developed impressions shall be imaged for preservation within a couple of hours after processing as they will become blurry over time.

6.4.2 AMIDO BLACK

Amido Black, also known as napthol blue-black, is a dye that stains proteins present in blood to give a blue-black product and is used to develop or enhance latent prints that have been left in blood on both porous and non-porous surfaces.

Control Test

Deposit blood onto a clean white lift card or medium of choice and process with Amido Black. A positive test will result in the development of a blue/black print.

Procedure

*There are several different recipes for Amido Black. The following is one procedure used. All blood must be dried prior to application. Amido Black processing involves three steps, all of which can be applied by dipping or using a sprayer or squirt bottle. The first step is to “fix” the blood proteins using the Amido Black rinse which contains methanol. The developing solution is then applied, covering the entire target area. The final step is the de-staining rinse.

Developed impressions shall be imaged for preservation.

6.4.3 ARDROX P-133D

Ardrox P-133D is a dye stain used for latent print luminescence in conjunction with alternate light sources and cyanoacrylate fuming on non-porous evidence. The dye stain does not develop friction ridge skin detail; it merely improves the contrast of cyanoacrylate enhanced prints. Ardrox can be used in conjunction with Rhodamine 6G. When using both stains, Ardrox should be used prior to Rhodamine 6G.

Control Test

Utilize a positive test from cyanoacrylate processing or use a fumed sebaceous control print on a medium of choice and process with Ardrox. A positive test will result in a developed control print in contrast to the background color when viewed with the alternate light source.

Procedure

Application of Ardrox may be accomplished through dipping or washing. Place the cyanoacrylate fumed evidence into the Ardrox for about ten minutes or wash the surface area with the stain. Allow the evidence to remain for ten minutes. Excess stain is removed by placing the evidence under running tap water until no yellow color remains.

Examine the evidence under the alternate light source at 350nm-480nm using a yellow filter.

Developed impressions shall be imaged for preservation.

6.4.4 BASIC YELLOW 40

Basic Yellow 40 is a fluorescent dye stain used for latent print luminescence in conjunction with alternate light sources and cyanoacrylate fuming on non-porous surfaces. The dye stain does not develop friction ridge skin detail; it merely improves the contrast of cyanoacrylate enhanced prints.

Control Test

Utilize a positive test from cyanoacrylate processing or use a fumed sebaceous control print on a medium of choice and process with Basic Yellow. A positive test will result in a developed control print in contrast to the background color when viewed with the alternate light source.

Procedure

It is recommended that the evidence be under-fumed, rather than over-fumed. Test a small section of the surface with Basic Yellow before applying to the entire surface. If the section completely fluoresces after rinsing and drying, do not use Basic Yellow to process that surface.

Apply the Basic Yellow 40 solution by submerging the evidence in a tray or container. Washing the solution over the surface using a wash bottle may also be done; however, do not spray the solution. Leave the Basic Yellow on the surface for about one minute then rinse with running tap water. Allow the evidence to air dry.

Examine the evidence under the alternate light source at 450nm-480nm using an orange filter.

Developed impressions shall be imaged for preservation.

6.4.5 CYANOACRYLATE ESTER (SUPERGLUE) FUMING

Fuming with cyanoacrylate will cause latent print residue on non-porous and some semi-porous surfaces to appear white in color. Latent prints developed this way are not easily damaged.

Option 1 – Standard Fuming Chamber

Control Test

Deposit a sebaceous rich print onto a clean black lift card or medium of choice and place the card within the fuming chamber. Monitor the process to avoid over fuming. A positive test will result in a developed control print.

Procedure

The addition of humidity to the fuming chamber prior to fuming plays a major role in successful development of white ridge detail. To allow maximum exposure of fumes to the evidence being fumed, evidence should be placed in the chamber so that all areas are exposed. After the humidity has been raised, the liquid glue is placed in a disposable container and placed on the heating source at the bottom of the chamber. The number of drops added is dependent on the size of the chamber and the surface area(s) of the evidence to be fumed. Alternatively, a number of Hard Evidence™ packs relative to the size of the chamber can be opened and taped to the side of the chamber or a fuming wand may be used to emit cyanoacrylate fumes. Once the cyanoacrylate is added, close the chamber. Viewing from outside the chamber, check the test print ten to twenty minutes after fuming begins. Once the test print begins to be visible, exhaust the fumes from the chamber thoroughly (for approximately fifteen minutes) before examining the item(s).

Developed impressions shall be imaged for preservation.

Option 2 – Cyvac™ Fuming Chamber

Control Test

Deposit a sebaceous rich print onto a clean black lift card or medium of choice and place the card within the fuming chamber. A positive test will result in a developed control print.

Procedure

Load evidence into the appropriate chamber according to the size of the item(s). If placing several layers of baggies in the tray, separate each layer with a sheet of paper. Do not place sealed containers in the chamber. Place a foil cup in each of the holes in whichever chamber being used. Place cyanoacrylate in the foil cups—four in the bell jar cup or two in each of the seven foil cups for the cabinet chamber. Seal the door and/or set the bell jar in place. Close the inlet and purge valves, leaving the outlet valve open. Turn on the pump switch. When the vacuum gauge reaches 10, turn on the re-circulate switch and the vapor release switch. Allow

the pumps to continue running with the outlet valve open for 20 to 40 minutes past the point when the vapor re-circulate temperature reaches 82 degrees (allowing the pumps to run longer will not cause overdevelopment). After the development time has elapsed, turn the vapor re-circulate, vapor release, and pump switches off. Slowly open the inlet and purge valves. Turn on the pump switch and allow the system to purge the fumes for 5 minutes. Turn off the pump switch, open the chamber and remove the foil cup(s). If any glue remains in a cup, it should be discarded. The foil cups may otherwise be re-used.

Developed impressions shall be imaged for preservation.

6.4.6 DFO (1,8–DIAZAFLUOREN–9–ONE)

DFO is a fluorescent reagent used to develop latent prints on paper and other porous surfaces. It excels in the development of latent prints on white and most pastel colored papers and glassine envelopes and packets. DFO reacts to the amino acids present in perspiration and should be used prior to Ninhydrin.

Control Test

Deposit an amino acid rich print onto a porous surface, process with DFO, and place into a heat chamber. A positive test will result in a developed print in contrast to the background color when viewed with the alternate light source.

Procedure

Application of DFO may be accomplished through spraying, brushing, or dipping (although it is possible to spray DFO, it is not recommended). After treating the evidence with the DFO, allow it to dry at room temperature. Place the item in a chemical processing oven between ~80-100°C for twenty minutes.

The DFO developed prints may be visible to the naked eye with white light but should be viewed under an alternate light source. Latent prints will develop in a pale purple/red color that generally luminesces between 495nm-550nm using an orange filter; however, brown paper may luminesce between 570nm-590nm using a red filter.

Developed impressions shall be imaged for preservation.

6.4.7 GENTIAN VIOLET (CRYSTAL VIOLET)

Gentian violet is used on tapes and decals. This technique is a biological stain that reacts with epithelial cells and sebaceous matter deposits of latent print residue. Caution must be used as it is possible to develop reversed images, especially when processing tape that has been wrapped around onto itself.

Control Test

Place finger on sticky side of test tape, similar in type and color to the evidence item and process with gentian violet. A positive test will result in a purple impression.

Procedure

Dipping method: Place the item into the gentian violet solution for approximately one to two minutes then rinse off with cold tap water,

Painting method: Paint the item with the gentian violet solution and let stand for approximately one to two minutes then rinse off with cold water.

If the color of the adhesive side of the tape is dark, lacking contrast with the dye, the reactive stain may be transferred onto fixed photographic paper for analysis. Place the stained tape between two sheets of developed photographic paper and place the paper inside a matte. Apply an iron or press to the matte until the paper is generally dry. Separate the tape and sheets of paper and allow to dry.

Developed impressions shall be imaged for preservation.

6.4.8 GUN BLUING SOLUTION

Gun bluing is a process that is used to develop latent prints on brass cartridges and cartridge cases. The reaction occurs on areas of metal unprotected by sebaceous latent print residue, creating a dark-colored coating on these areas.

Control Test

Deposit a sebaceous rich print onto a clean brass item and process with Gun Bluing solution. A positive test will result in a developed control print.

Procedure

Light cyanoacrylate fuming (not in a fuming chamber) has been shown to be beneficial prior to testing with gun bluing solution. Ideally, no other processing prior to using this solution should be conducted. Add one drop of Gun Bluing reagent to one-two milliliters of distilled water. Immerse the evidence for several seconds and closely monitor for the development of latent prints. Halt the development by rinsing with tap water and air dry.

Developed impressions shall be imaged for preservation.

6.4.9 1,2-INDANEDIONE (IND) AND 1,2-INDANEDIONE+ZINC CHLORIDE

1,2-indanedione is used to develop latent prints on paper and other porous surfaces. IND reacts to amino acid residue in latent prints to produce a pink-red color that also fluoresces.

Control Test

Deposit an amino acid rich print onto a porous surface, treat with IND, and place into a heat chamber. A positive test will result in a developed print in contrast to the background color when viewed with the alternate light source.

Procedure

Whether using 1,2-indanedione or 1,2-indanedione+zinc chloride, dip the evidence item in the reagent, air dry in the fume hood, and repeat both steps. Place the item in the oven at ~100°C for ten to twenty minutes or dry iron for twenty minutes. If using the dry iron, place sheets of thick paper between the evidence and the iron; don't directly iron the prints.

Examine the evidence under the alternate light source at 515nm-570nm using an orange filter.

Developed impressions shall be imaged for preservation.

6.4.10 M.B.D.

M.B.D. is a fluorescent dye stain used for latent print luminescence in conjunction with alternate light sources and cyanoacrylate fuming on non-porous evidence. The dye stain does not develop friction ridge skin detail; it merely improves the contrast of cyanoacrylate enhanced prints.

Control Test

Utilize a positive test from cyanoacrylate processing or use a fumed sebaceous control print on a medium of choice and process with M.B.D. A positive test will result in a developed control print in contrast to the background color when viewed with the alternate light source.

Procedure

Application of M.B.D. may be accomplished through immersion in the solution or by using a spray device or squirt bottle. Allow the evidence to dry.

Examine the evidence with the alternate light source at 415nm-505nm using an orange filter.

Developed impressions shall be imaged for preservation.

6.4.11 NINHYDRIN

Ninhydrin is a chemical method for developing latent prints on porous surfaces and absorbent materials such as paper, cardboard, and smooth raw wood. This method is based on the reaction of the Ninhydrin and the amino acids, proteins, and peptides that are present in the latent print residue.

Control Test

Deposit an amino acid rich print onto a porous surface, process with Ninhydrin, and place into a heat/humidity chamber. A positive test will result in a purple-colored print.

Procedure

Application of the Ninhydrin solution may be accomplished through spraying, brushing, or dipping. After treating the evidence with the Ninhydrin solution, allow it to dry at room temperature. A 24-hour development period is recommended. Subjecting the item to a combination of heat and humidity can accelerate the reaction.

Developed impressions shall be imaged for preservation.

6.4.12 NINHYDRIN HT

When attempting to chemically develop latent prints on thermal and carbonless specialty papers with standard Ninhydrin reagent, the papers often darken, possibly obliterating latent prints and any writing on the papers. The specialty paper Ninhydrin solution develops latent prints on these papers without turning them black.

Control Test

Deposit an amino acid rich print onto thermal paper and process with Ninhydrin HT. A positive test will result in a purple-colored print.

Procedure

Spray or briefly immerse the specialty paper in the solution, remove, and dry. Place the treated paper in the dark, at room temperature for 48-72 hours. Heat should be avoided. Each page of carbonless paper should be processed individually.

Developed impressions shall be imaged for preservation.

6.4.13 OIL RED O

Oil Red O is used on porous surfaces, including those that have been previously wet. Oil Red O is a hydrophobic dye which targets lipids in fingerprint deposits. Oil Red O should be used on dry or wet porous surfaces.
Oil Red O should be integrated into your sequence on dry porous surfaces after ninhydrin/indanedione and before physical developer.

Dry porous surface sequence should be:
DFO-NIN-ORO-PD or
IND-ORO-PD

Oil Red O should be integrated into your sequence on wet porous surfaces before physical developer.

Wet porous surface sequence should be:
ORO-PD

Control Test

Place a sebaceous-rich print on a porous surface, such as clean white paper. Process with Oil Red O. A positive control will give a red colored print.

Procedure

First, immerse the evidence item in the stain solution and shake gently for 60 to 90 minutes. Usually, strong fingerprints will give good results after only 5-10 minutes. Remove the item from the stain solution and drain. Immerse the item in the buffer solution to adjust the pH. Let the item dry.

Photograph any developed impressions.

6.4.14 PHYSICAL DEVELOPER

Physical developer is used on porous evidence and is effective on paper bags, currency, and items that have been subjected to moisture. Physical developer reacts with fats, oils, and waxes present in perspiration or on the skin surface.

Control Test

Deposit a sebaceous rich latent print onto a clean white paper or medium of choice and process with physical developer. A positive test will result in a gray/black print.

Procedure

Immerse the evidence in the Maleic Acid pre-wash solution for ten minutes or until no bubbles are coming from the paper. Then immerse the evidence in the working solution. Gently rock the dish until the latent prints develop into dark gray images. Remove the evidence when the background appears significantly darker or after twenty minutes. Immerse the item in distilled water and rinse until there is no yellow stain and the water runs clear. Wash in cold tap water for an additional five to ten minutes. Thoroughly dry the evidence.

Developed impressions shall be imaged for preservation.

6.4.15 POWDER PROCESSING

Powder development techniques are used to develop friction ridge skin impressions on non-porous and semi-porous items. Powder development makes surface ridge detail visible and improves the contrast of already visible detail. This development technique facilitates preservation via imaging and lifting the impression.

The type of powder selected for processing will depend upon:

- The contrast with the surface on which impressions are to be developed.
- The nature of the surfaces to be processed.
- Any special application attributes of the powders available.
- The anticipated means of preservation (imaging or lifting).

Selecting the proper applicator is dependent upon:

- The type of powder used (magnetic wand with magnetic powder, etc.).
- The size of the area to be dusted (cotton ball, brush, etc.).
- The type of surface to be dusted (metal, sticky, etc.).

When there is any doubt as to the suitability of a powder for processing a surface, a test print can be made. A similar surface to the suspected surface should be used. If there is none available, then a small area of the suspected surface may be dusted with the most suitable powder, wiped clean, and used for testing. The test will be documented in the scientist's notes and the test impression will be destroyed immediately after it has served its purpose.

Procedure

Dusting with powders

The key to successful "conventional" powder application (dusting) is the use of a small amount of powder with a delicate touch. Touch only the ends of the brush bristles to the powder. The excess powder should be shaken or tapped off.

Use a smooth motion to guide the brush over the suspected area or over the barely discernible print while very lightly brushing the bristles across the surface. When sufficient ridge detail has been developed so that the direction of flow of the ridges can be observed, continued brushing should follow the ridge flow. Occasionally, in spite of all precautions, the powder will adhere so tenaciously to the object on which the latent is found that brushing will not remove the excess powder. If so, a lifting technique may be used to remove the excess powder (this process is discussed under Lifting Techniques).

Sometimes a latent print may be enhanced after the initial lifting by additional processing with brush and powder or the use of fluorescent dye stains.

The adherence of powder to a latent print can be enhanced by using the “breath technique”. Exhaling warm breath on a surface while dusting for latent prints sometimes adds moisture to the latent print residue, thereby enabling the powder to adhere to the ridge structure of the latent. All moisture, however, should be visibly evaporated from the surface prior to applying powder. This technique should only be utilized if DNA testing will not be pursued.

Proper use of the magnetic brush (wand) and magnetic powders is similar to the "dusting" procedure described for conventional powders. When the "closed" magnetic wand is inserted into the magnetic powder container the powders will be picked-up with the tip of the wand. The powders actually form a bristle-less brush. Only the powder "bristles" should touch the surface being processed, and not the wand itself. A light, smooth stroking motion is used in guiding the magnetic wand over the suspected area.

When the rod is pulled to a fully extended position the powder will be released from the tip. Excess powder should be removed from the processed area by passing the wand over the area without it actually making contact with the surface.

An alternate light source will be required to examine areas that have been processed with fluorescent powders. Impressions developed with powders on a smooth surface may be preserved via imaging and/or lifting. Impressions developed on textured surfaces or with fluorescent powders shall be preserved via imaging.

Lifting Techniques

When using lifting tape to remove a developed impression, care should be taken in unrolling the tape from a roll so that hesitation creases do not occur. The unrolling should be performed in one smooth, continuous action.

The application of the lifting tape (or other lifting device) to the surface should also be in one smooth motion. The bulb of your finger or a rounded object may be pressed to the tape during application to preclude air bubbles and to ensure good contact with the lifting surface. Some bubbles can be eliminated effectively (without damaging the impression) by applying pressure with your finger (or other smooth, rounded object) to force the air pocket out at the edge of the tape. The lifting of the impression away from the surface should also be in a smooth continuous motion.

The lift shall be marked with the following:

- Date of lift
- Latent Prints Laboratory Case number
- Location of lift
- Name or initials of person making the lift
- Unique lift number

A diagram of the lift location on the object is recommended. An arrow indicating the direction of the lift is also valuable for determining the orientation of the impression(s) and how an object was touched or handled.

Any latent impressions appearing on the perimeter of the lift, deposited by the individual making the lift, shall be crossed-out and initialed.

6.4.16 POWDER SUSPENSION (STICKY-SIDE, WETWOP™)

Powder suspension is used to process the adhesive side of tapes, labels and other adhesive items for latent prints. The Wetwop™ solution can be used on various types of tapes, labels, Post-It® notes, stamps, bandages, and rubber gloves (i.e. latex and nitrile) as well as the non-adhesive side of tapes.

Control Test

Deposit a print on a test medium of similar type and color as the evidence and process with the appropriate powder suspension technique. A positive test will result in a developed print in contrast to the background color.

Procedure

"Sticky-Side" powder comes as a pre-packaged kit. Place about 1 teaspoon of Sticky-Side powder into a shallow container. Mix a 1:1 solution of water and Photo-Flo 200 and shake well. Slowly add this solution to the powder in a shallow jar until you have a paste with the consistency of thin paint. Use a brush to "paint" the liquid mixture onto the adhesive surface. Leave the liquid on the tape for no more than 10 seconds, and then gently rinse it off with water. The tape can be rinsed under running water, but the preferred method is to gently agitate it in a bowl of water. Allow the tape to dry at room temperature.

Wetwop™ is available in both black and white colors. Black can be used to process the adhesive and non-adhesive sides of most colored tape surfaces. White can be used to process dark colored and clear adhesive and non-adhesive surfaces. In some instances, both black and white solutions can be used in sequence to present contrast for better visualization of prints.

Remove and collect any foreign material from the item. If the adhesive substrate is wadded or stuck on another surface, attempt to remove and expose the adhesive surface. Shake the Wetwop™ bottle thoroughly and pour a small amount into a clean beaker or dish. Apply Wetwop™ with an appropriately sized brush, using a painting motion to completely cover the surface. Allow the Wetwop™ solution to stand on the adhesive or non-adhesive surface for 15-30 seconds, and then rinse the solution off with a gentle stream of tap water. For glove processing, rinse the Wetwop™ solution quickly to avoid background staining. Allow the evidence to dry.

Developed impressions shall be imaged for preservation.

6.4.17 R.A.M.

RAM is a combination of the dye stains Rhodamine 6G, Ardrox-133D, and M.B.D. It is a fluorescent dye stain used for latent print luminescence in conjunction with alternate light sources and cyanoacrylate fuming on non-porous evidence. The dye stain does not develop friction ridge skin detail; it merely improves the contrast of cyanoacrylate enhanced prints.

Control Test

Utilize positive test from cyanoacrylate processing or use a fumed sebaceous control print on a medium of choice and process with RAM. A positive test will result in a developed control print in contrast to the background color when viewed with the alternate light source.

Procedure

After the evidence has been processed by cyanoacrylate fuming, apply RAM by dipping, washing, or using a spray bottle. Allow the evidence to air dry.

Examine the evidence with the alternate light source at 415nm-535nm using an orange filter.

Developed impressions shall be imaged for preservation.

6.4.18 RHODAMINE 6G

Rhodamine 6G is a fluorescent dye stain used for latent print luminescence in conjunction with alternate light sources and cyanoacrylate fuming on non-porous evidence. The dye stain does not develop friction ridge skin detail; it merely improves the contrast of cyanoacrylate enhanced prints.

Control Test

Utilize a positive test from cyanoacrylate processing or use a fumed sebaceous control print on a medium of choice and process with Rhodamine 6G. A positive test will result in a developed control print in contrast to the background color when viewed with the alternate light source.

Procedure

After the evidence has been processed by cyanoacrylate fuming, apply the Rhodamine 6G working solution by dipping or by using a spray device or squirt bottle. Allow the evidence to dry.

Examine the evidence with the alternate light source at 495nm-540nm using an orange filter.

Developed impressions shall be imaged for preservation.

6.4.19 SILVER NITRATE

Silver Nitrate can be used on porous surfaces (i.e. wood) that have not been wet. It reacts with chlorides present in latent prints to form a dark gray deposit once exposed to light. Silver Nitrate should be used after Ninhydrin if processing with both.

Control Test

Deposit a sweat or saline covered finger onto a porous surface and process with Silver Nitrate. A positive test will result in a developed print in contrast to the background color.

Procedure

Immerse the evidence in the solution for a maximum of five seconds. Allow the evidence to dry completely in the dark. The evidence can also be exposed to sunlight or a UV light source at 366nm and observed until the best contrast is observed. Store the evidence in the dark until imaged.

Developed impressions shall be imaged for preservation.

6.4.20 SMALL PARTICLE REAGENT

Small Particle Reagent (SPR) is a suspension of fine Molybdenum Disulfide particles in detergent solution. This process can be used on wet, non-porous surfaces. SPR adheres to fatty constituents of latent prints to form a gray deposit.

Control Test

Deposit a sebaceous rich print onto a white lift card or substrate similar to the evidence being processed and process with SPR. A positive test will result in a gray/black print against the background.

Procedure

Bath method: Shake the container of SPR working solution and pour enough of the solution into a tray or tank to cover the evidence to be processed. Stir the solution thoroughly to ensure that all powder is suspended in the liquid and immerse the evidence immediately. Keep the evidence stationary at the bottom of the dish for approximately 30 seconds and then remove it carefully. A thick gray film will be seen coating the evidence item's surface. Invert the evidence and gently draw it across the surface of tap water in a second tray or tank of similar size. Agitate the evidence gently. The grey film should wash off, revealing developed latent print detail. Allow the evidence to dry at room temperature.

Spray method (If being used outside during rain, shelter the area to be treated from direct rainfall.): Shake the container of working solution and fill the spray bottle, shake well and adjust the nozzle to give a cone-shaped jet. Spray the area to be examined starting at the top and working downwards. If signs of latent print development appear, continue spraying just above the relevant area until there is no further buildup of gray deposit. If it is necessary to remove excess powder from developed prints, spray water gently above developed prints with a second spray bottle. Allow the surface to dry.

Developed impressions shall be imaged for preservation.

6.4.21 SUDAN BLACK

Sudan black is a dye stain that is used to process non-porous surfaces contaminated with grease, foodstuffs, or dried deposits of soft drinks and will also enhance cyanoacrylate developed latent prints. This process is ineffective on dark or printed plastic surfaces. Sudan black stains fatty components of sebaceous secretions to produce a blue-black print.

Control test

Deposit a sebaceous rich print onto a white lift card or medium of choice and process with Sudan black. A positive test will result in a developed print in contrast to the background.

Procedure

Immerse the evidence in the working solution or float on the surface for two minutes. Rinse the evidence under cool, gently running tap water until excess dye has been removed from the background and allow to dry at room temperature.

Developed impressions shall be imaged for preservation.

6.4.22 TAPEGLO™

TapeGlo™ is used to process the adhesive side of tape (i.e. plastic-backed, cloth or paper-backed adhesive tape) for latent prints. It is a reusable fluorescent dye stain used for latent print luminescence in conjunction with alternate light sources.

Control Test

Deposit a print on a test medium of similar type and color as the evidence and process with TapeGlo™. A positive test will result in a developed print in contrast to the background color.

Procedure

Place the tape adhesive-side up in a tray or dish. Application of TapeGlo™ may be accomplished through spraying, brushing, or dipping. After completely covering the adhesive side, allow the solution to remain on the surface for ten to fifteen seconds. Gently rinse the surface.

Examine the evidence with the alternate light source at 450nm using an orange filter.

Developed impressions shall be imaged for preservation.

6.4.23 DEVELOPING LATENT PRINTS ON HUMAN SKIN

Lift Transfer Method:

For live victims, a piece of black plastic or RC photo paper developed as black can be held against areas suspected as possibly bearing latent prints. Other nonporous surfaces such as a mirror, glass, or metal plate may be used instead of photo paper. A sponge or soft pad should be placed between the scientist's hand and the photo paper to improve contact with the victim's skin.

Hold the transfer surface against the skin for 15 to 20 seconds. The nonporous transfer surface should then be cyanoacrylate fumed to develop latent prints which may have transferred. Condensation on the body is acceptable as any water in the latent print residue will aid polymerization with cyanoacrylate fumes.

After cyanoacrylate fuming, further development of the nonporous transfer surface should include luminescent dye stain, alternate light source excitation, and (lastly) powder rubbing.

For deceased victims, the body's skin surface should be between 72 and 80 degrees for optimal fatty/waxy impression transfer. Warm the lift card or other transfer medium with a portable hair dryer just before lifting (warming it to above 86°F has been suggested by some researchers).

Cyanoacrylate Fuming Cadavers:

Ideally the body should not be refrigerated prior to fuming because moisture can destroy impressions that might otherwise be developed. If already refrigerated, permit all condensation moisture to evaporate upon removing the body from the cold locker/drawer.

An airtight plastic tent can be assembled over the body and fumed with cyanoacrylate. A small, battery powered fan may be used to help with fume distribution.

After fuming, dust the body using a contrasting color powder. Developed impressions shall be imaged for preservation.

6.5 RECORDING FRICTION RIDGE EXEMPLARS

When called upon to record finger and palm print exemplars, the scientist shall record all friction ridge skin detail which may be required for comparison. Major case prints consist of recordings of all the friction ridge detail present on the palmar surfaces of the hands and the inner surfaces of the fingers. If necessary, friction ridge detail on the bottom of the feet and toes may also be recorded.

Exemplars should be recorded with black ink on a white background card whenever possible. An 8" x 8" template card is preferred, but not required.

When completed, each page of the exemplars must be signed and dated by the person recording the exemplar(s). The source of the exemplars must be noted on each card and should also be signed by the donor.

6.5.1 SUSPECT, VICTIM, AND ELIMINATION PRINT EXEMPLARS

The area of the friction ridge skin being recorded should be thoroughly washed. Firmly roll a thin, even film of ink over the entire surface being recorded.

Fingers shall be recorded by rolling from each edge of the fingernail to the other and should include the entire joint from the palm to the fingernail. The tips of the fingers may also be recorded by placing the inked tip along the fingernail on the card at a 45° angle and shifting from one side of the tip to the other. Record friction ridge skin formations from the fingers in order, beginning with the right thumb and proceeding through the fingers of the right hand and then concluding with the left thumb and proceeding through the fingers of the left hand. The exemplars must be labeled immediately to clearly indicate which finger is which.

Palms are best recorded using a cylindrical object 3 inches or more in diameter. The card shall be positioned around the cylinder and held in place with a rubber band around each end. The inked heel of the palm is placed on the edge with fingers together and pointed straight ahead. Roll the cylinder backwards with the palm of the subjects hand until the tip areas of the fingers are recorded. If a cylindrical object is not available, the inked hand may be recorded with a stamping action onto the center of the card (be sure to place adequate pressure in the raised/cupped center of the hand). Record the edges of the hypothenar and thenar areas with a stamping action on the white card just outside those respective areas on the previously recorded palm print.

Foot prints may be recorded in a manner similar to the palms, either by rolling the foot from the heel to the toes or by stamping straight down onto a white card. Be sure to have a large enough card or piece of paper to record the entire surface of the friction ridge skin.

6.5.2 DECEASED PERSON EXEMPLARS

If possible, the procedures for recording suspect, victim, and elimination print exemplars should be followed. In most cases, however, unique measures will be required to adequately record friction ridge detail of deceased persons.

The area of the friction ridge skin being recorded should be thoroughly washed. In cases where rigor and decomposition have affected the pliability of the skin, the area being recorded may be hydrated by injecting water or embalming fluid under the surface. In some cases, the outer layer of the skin may be removed and similarly cleaned and hydrated in preparation for recording the friction ridge skin detail. The scientist shall determine the best means for preparing the skin.

In lieu of rolling ink onto the friction ridge skin, fingerprint powder may be applied using a standard fingerprint brush. If powder is used, or if the inked area cannot be recorded directly onto a contrasting card, the friction ridge detail may be recorded by applying clear or frosted lift tape to the surface of the skin, removing it, and placing it on a piece of transparent plastic. The recorded area may then be attached on the exemplar card with the transparent plastic covering the lift tape (the print must be examined with the adhesive side of the tape facing the examiner).

If the described methods are unsuccessful in obtaining the necessary exemplars, digital imaging may be employed to record the friction ridge skin detail.

7.0 DIGITAL IMAGING

Digital imaging technology is used to preserve, document, and analyze impressions which have the potential to be of evidentiary value. Images generated for the purpose of examination will be captured, stored, and documented in the chain of custody. Images generated for the purposes of orientation and documentation will be retained in the case record.

Digital imaging terminology used in the Latent Prints Laboratory will be consistent with that described in "Definitions and Guidelines for the Use of Imaging Technologies" posted by the Scientific Working Group on Imaging Technologies (SWGIT).

7.1 IMAGE CAPTURE

When possible, examination quality images should be captured in uncompressed formats at a calibrated resolution exceeding 1000 ppi. Examination quality images of impressions should be scalable, preferably to include a scale placed on the same plane as the impression.

Each image will be documented in the case notes with the unique portion of the image file name and noting which impression number(s) it contains.

Orientation images may be captured without minimum resolution requirements.

Image file type should be appropriate. Compressible files should be avoided when the resolution is low.

7.2 DIGITAL IMAGE STORAGE

Original digital image files will be saved to a permanent storage device. Approved digital media and the Digital Imaging System (DIS) database are to be used for storage. Images retained in the DIS are considered part of the case record.

When saving examination quality images to digital media, the same format in which they were captured should be used. The unaltered saved images will be considered the original images. If possible, the media will be marked with the date it was created, the CLD case number, scientist's initials, requesting agency name and case number. The media will be documented as generated evidence in the chain of custody, and returned to the requesting agency. A printed manifestation of the examination quality image (original and/or enhanced) will also be included with the returned media. Copies of the original examination quality image files may also be stored in the DIS.

All printed copies of digital images are considered working copies.

7.3 IMAGE ENHANCEMENT

Image enhancement is permitted. No enhancement work shall be done on an original image, only on a copy of an original image. Image enhancement techniques employed by a scientist must be explainable and within the scope of their training.

When recording the processing steps for enhancements of examination quality images submitted or generated in the laboratory, the information will be recorded in the DIS or in the case notes. The resultant enhanced image will also be retained in the DIS or on digital media.

<u>When documenting / saving enhancements necessary</u>:
1. Images where enhancements are essential for their usefulness for analytical result or comparison (beyond simple processes).

If enhancements of digital images (whether generated in lab or submitted by agency) are used for comparison or identification, a print-out of the enhanced image(s) should be returned to the agency and documented as generated evidence.

When documenting / saving enhancements not necessary:

1. Enhancements involving basic processes, such as converting to grayscale, inverting, crop, and minimal contrast adjustments.
2. Images generated of impressions previously preserved (such as on lifts, inked prints, or photographed impressions submitted in printed form) unless this image falls under #1 above.
3. Image enhancements used for AFIS, or not for use in comparisons or evaluations.

8.0 FRICTION RIDGE IMPRESSION EXAMINATIONS

Friction ridge impression examinations are conducted by examiners using the Analysis, Comparison, Evaluation, and Verification (ACE-V) methodology in consideration of both qualitative and quantitative aspects. ACE is not generally applied as a strictly linear process because it may include a return to any previous phase. Application of ACE-V includes observations, measurements, assessments, decision-making, and documentation supported by the education, training, skill, and experience of the examiner.

The examination of friction ridge impressions and the resulting conclusions are based on ridge flow and ridge paths; the location, direction, and spatial relationships of minutiae; and ridge structure. The analysis phase leads to the determination of suitability for comparison, leading to an evaluation which may conclude in identification or exclusion, or shall be determined to be inconclusive. These conclusions are based on the following premises:

- Friction ridge skin bears an extremely complex, unique, and persistent morphological structure.
- Notwithstanding the pliability of friction ridge skin, the contingencies of touching a surface and the nature of the matrix, an impression of friction ridge skin structure may be left following contact with a surface.
- This impression may display features of varying quality (clarity of ridge features) and specificity (weighted values and rarity).
- Notwithstanding variations in clarity and specificity, the unique aspects of friction ridge skin contain highly discriminative features.
- An impression that contains sufficient quality and quantity of friction ridge features can be identified to, or excluded from, a source.
- The use of a fixed number of friction ridge features as a threshold for the establishment of an individualization is not scientifically supported.

8.1 SCOPE

The ACE-V methodology is applied to examinations and comparisons of friction ridge impressions. This section applies not only to the more common comparisons of unknown to known impressions, but is also applicable to known to known and unknown to unknown comparisons. The application of the ACE-V methodology to casework requires examiner competency as established through the Latent Prints Training Manual and Crime Laboratory Division Quality Manual.

8.2 FACTORS AFFECTING EXAMINATIONS

The following factors affect the qualitative and quantitative aspects of friction ridge impressions. A competent examiner will understand these factors, recognize that they occur in friction ridge impressions, and understand how they influence friction ridge impression reproducibility. Failure to properly assess the occurrence and influence of these factors could result in misinterpretation. When applicable, the following factors must be considered in all steps of the ACE-V methodology:

- Anatomical aspects include the condition of the skin (e.g., scars and warts) and the morphology of the hand and foot relative to the shape and contour of the substrate.

- Transfer conditions include pressure applied during transfer, slippage or twisting, sequence of deposition (i.e., double taps and overlays), and an understanding of the limitations of friction ridge pliability.

- Matrix includes bodily secretions and contaminants (e.g., sweat, blood, paint, dirt, oil, grease).

- Detection techniques that can be one or more of the following: optical (i.e., light sources and illumination techniques), physical, or chemical processing techniques.

- Recording or preservation techniques, such as photography, lifting, live-scan, and ink.

- Substrate (e.g., porous, non-porous, semi-porous, smooth, rough, corrugated, pliable, or textured surfaces).

- Environmental conditions (e.g., protected, unprotected, wet, dry, cold, or hot).

8.3 LEVELS OF FRICTION RIDGE IMPRESSION DETAIL FOR EXAMINATIONS

The ACE-V methodology of friction ridge impression examination utilizes a qualitative and quantitative assessment of Level 1, Level 2, and Level 3 details. Level 1 detail refers to the overall ridge flow and may include pattern interpretation. Level 2 detail refers to individual friction ridge paths, friction ridge events (e.g., bifurcations, ending ridges, dots, and continuous ridges), and their relative arrangements. Level 3 detail refers to ridge structures (edge shapes and pores), and their relative arrangements. Creases, scars, warts, incipient ridges, and other features may be reflected in all three levels of details.

8.4 PROCEDURE FOR FRICTION RIDGE IMPRESSION EXAMINATIONS (ACE-V METHODOLOGY)

8.4.1 ANALYSIS

Analysis includes the assessment of an impression to determine its suitability for comparison based on Level 1, 2, and 3 details and other relevant information as described in Section 8.2. This assessment also includes the possible anatomical origin and orientation of the impression. Additional analysis involves the recognition and documentation of anatomical aspects and features to be considered in any subsequent comparison. Analysis determines if the impression is suitable for comparison.

The analysis may also provide anatomical information to prioritize the potential corresponding areas and limit unnecessary comparisons. Certain orientation indicators such as recurves, deltas, creases, and scars may provide specific guidance where to begin the comparison.

Determination of Suitability

Suitability for comparison is the determination that there is adequate quality and quantity of friction ridge features in an impression for either identification or

exclusion upon comparison to a corresponding suitable impression. The assessment is based on the quality of features (clarity of the observed features), the quantity of features (amount of features and area), the specificity of features, and their relationships.

Quality

Quality is the assessment of the clarity of ridge features. Generally, as quality increases so does the discernibility and reliability of the ridge features. It is recognized that quality is not necessarily constant throughout an impression. The assessment of quality may represent just the areas of highest quality, a range of qualities, or a map or rating system of quality of various regions in a single impression.

Table 1 shall be used for categorizing the levels of quality of the features in an impression (unknown or known). The level of quality determines the degree of tolerances that will be used during the comparison process. High quality will lead to low tolerances and conversely low quality will require high tolerances.

Tolerance is the allowance of variation in appearance of friction ridge features (due to the factors listed in section 8.2) that will be accepted during comparison, should the corresponding print be available.

There are subjective as well as objective elements to this categorization, but the descriptions provided in the table should allow a meaningful quality description to be made.

Quality	
High	Level 1 is distinct; Level 2 details are distinct; There are abundant distinct Level 3 details
Medium High	Level 1 is distinct; Most of the Level 2 details are distinct; There are minimal distinct Level 3 details.
Medium Low	Level 1 is distinct; Few of the Level 2 details are distinct; There are minimal distinct Level 3 details.
Low	Level 1 may not be distinct; Most of the Level 2 details are indistinct; There are no distinct Level 3 details

Table 1: Categories of quality defined as a function of levels of details observed.

The utility of these categories is to assist in the analysis of suitability and subsequent evaluation and verification. The quality assessment should not be considered as the sole criteria for a decision threshold.

Quantity

Quantity, as applied in this section, is the number of ridge endings, bifurcations, and dots (minutiae) in contiguous ridges and other unique features, if present, such as scars, creases, and incipient ridges. All features are considered here,

including indistinct features for which type or exact location cannot be established.

The utility of the quantity of features is to assist in the analysis of suitability and the recognition of alternative levels of case complexity as they relate to sufficiency with subsequent evaluation and verification. The quantity of features should not be considered as the sole criteria for a decision threshold.

Designating Impressions for Comparison

Any impression that is potentially suitable for identification shall be designated for comparison. Impressions suitable for exclusion only will not generally be considered, but may be designated for comparison at the examiner's discretion or upon a specific request by the submitting agency.

No further analysis will be required for any impressions that are not designated for comparison. If an impression is designated for comparison, further analysis determines the features and their tolerances to be used in the comparison.

Documentation of Impressions Designated For Comparison

An impression designated for comparison will be given a unique sequential identifier. The unique identifier for each impression will be marked in close proximity to the impression on copies of the lift or printed image. It is also recommended that the unique identifiers be marked on lifts, printed images, or within generated digital images returned to submitting agencies. Copies of annotated lifts or images will be retained in the case record.

A quality assessment (using Table 1) will be noted. The complexity of the impression as described below will dictate the extent of the documentation:

- Non-complex – High or Medium High quality with a plainly sufficient quantity of features. Only the minimum documentation of the relevant features that may be used as a basis for a conclusion is required.

  An impression categorized initially as non- complex may be re-classified as complex if the following modifying factors are present: low specificity of features, significant distortion (e.g., multiple tap, superimposed impression, extreme pressure leading to tonal reversal, and slippage), high tolerances, or the original conclusion is contested during verification.

- Complex – Low or Medium Low quality with uncertain sufficiency of the quantity of features. Extensive documentation of the relevant features used as a basis for a conclusion is required.

  An impression categorized initially as complex may be re-classified as non-complex if modifying factors are present such as high specificity of features, presence of creases, scars, and open fields.

- Justification for reassignment of complexity shall be documented.

Minimum documentation of analysis includes the following, if known:

- Anatomical source (e.g., fingerprint, palm print)
- Anatomical orientation (e.g., distal direction)

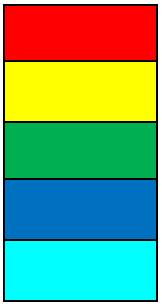
- Presence of level 1 detail
- Presence of level 2 detail
- Substrate
- Development medium
- Preservation method (e.g., lift, photograph, legible copy)

Extensive documentation of analysis includes the following, either through narrative or image mark-up:

- Minimum documentation requirements
- Additional factors, if known, such as matrix, deposition pressure, lateral movement, rotational movement, level 3 detail, or other friction ridge skin detail (e.g., creases, scars)
- The location of sufficient level 2 features to establish at least one target group for comparison and/or reach a conclusion of identification or exclusion

Image mark-ups shall be clear in their intent or color-coded. When a color-coded image mark-up is utilized, the following key should be used:

- Red – unclear areas of ridge flow
- Yellow – debatable minutiae
- Green – definitive minutiae
- Blue – definitive ridge edges and pores
- Cyan – scars and creases
- Ridges may be traced using any semi-transparent color



Note: If a different color scheme is used, it shall be documented in the case notes

A legible copy of the unmarked latent print shall be retained in the case record.

Analysis documentation of a latent print designated for comparison shall be completed prior to comparison.

Documentation of Impressions Not Designated For Comparison:

The presence of impressions assessed but not designated for comparison shall be documented in the case notes. Documentation may be accomplished by making a “no value” notation (e.g., “NV”) on the legible copy retained as part of the case record or by indicating in the case notes that “no value” impressions are present on a lift or photograph. No further documentation of the assessment is required.

8.4.2 COMPARISON

Comparison is accomplished through the side-by-side observation of two or more impressions using all levels of details to determine whether the impressions are in

agreement or disagreement based upon features, sequences, and spatial relationships within the tolerances of clarity and distortion.

Comparison of impressions known to be from different anatomical sources is unnecessary. If a comparison cannot be completed because the exemplars required for a conclusive comparison are not available, the necessary exemplars should be requested to either complete the current request or for a possible subsequent request.

If the anatomical source of one or more of the impressions being considered is unknown, all possible areas shall be compared.

Documentation of Comparisons

Documentation that records the information relied upon during comparison shall be made for each comparison.

If re-analysis of the latent print during comparison results in new information, supplemental notes shall be added and dated.

A legible copy of known prints used for comparison will be retained in the case record. The origin of the exemplars (e.g., printed from archive, direct submission) shall also be documented in the case notes.

Known prints that are deemed insufficient for comparison, or that contain any factors that adversely affect the comparison, shall be documented. The quality and quantity of the information present will dictate the extent of the documentation. These factors include:

- Incomplete recording of the friction ridge skin
- Missing anatomical sources (e.g., palms, areas of fingers)
- Unclear recording of the friction ridge skin

When a color-coded image mark-up is utilized to document a comparison, the following key should be used:

- Orange – Clear corresponding features
- Purple – Corresponding features in a target area

8.4.3 EVALUATION

Evaluation is the formulation of a conclusion based upon the analysis and comparison of friction ridge impressions. An examiner will evaluate whether an impression is from a different source or the same source as the compared impression, or if the features between the compared impressions are insufficient to either identify or exclude (inconclusive).

Identification

Identification is the decision by an examiner that there are sufficient features in agreement to conclude that two areas of friction ridge impressions originated from the same source.

The standard for identification is a demonstrable and justifiable consistency between two impressions. Identification of an impression to one source implies

that the likelihood the impression was made by another source is so remote that it is considered a practical impossibility.

Exclusion

Exclusion is the decision by an examiner that there are sufficient features in disagreement to conclude that two areas of friction ridge impressions did not originate from the same source.

The standard for exclusion is a demonstrable and justifiable inconsistency between the unknown impression and all relevant anatomical areas of the known subject. Exclusion of a subject can only be concluded if all relevant anatomical areas are represented and legible in the known exemplars. In addition, the distal orientation of an unknown impression must be able to be reliably determined in conjunction with the observed Level 1 and 2 details for exclusion to be considered. Case notes and reports shall clearly state if the exclusion refers only to the source or the subject.

Level 3 details cannot be the sole factor to eliminate a source.

Inconclusive Evaluations

If an unknown impression cannot be excluded or identified, the evaluation shall be considered inconclusive. The reason for each inconclusive evaluation must be documented and reported. Inconclusive evaluations may be the result of poor quality exemplars, uncertainty in the distal orientation or anatomical source of an unknown impression, or upon determination in comparison that the detail in an unknown impression is insufficient to either identify or exclude the subject of a comparison.

Documentation of Conclusions:

All identifications and exclusions shall be documented on the Latent Print Verification worksheet and will include the unique impression identifier, unique identifier of the exemplars (as appropriate, see below), anatomical source(s) identified or excluded, initials of the examiner reaching the conclusion, and the date the conclusion was reached.

- For known exemplars that have been obtained by the analyst - documentation shall include state identification number (or other identification number such as the FBI identification number) and should also include the subject name if available; additional information such as date of birth, date of arrest should also be documented.
    - If numerous exemplars are submitted or obtained for the same individual a brief descriptor (e.g., last four digits of the TCN) or sequential indicator (e.g., K1, K2, K3…) shall be used to differentiate the exemplars
- For known exemplars that have been submitted – documentation shall include the item number (contributing agency or LPL item number) and should include additional information such as name and state identification number or date of birth.

In rare instances a request can be made to compare two unknown impressions. In these instances the unique identifier of each impression, initials of the examiner reaching the conclusion, and the date the conclusion was reached shall be documented on the Latent Print Verification worksheet.

Documentation to support the conclusion shall be such that another competent examiner could evaluate what was done and interpret the conclusion. The documentation must be sufficient to demonstrate the basis upon which the conclusion was based. This may include a combination of written notes and printed images (Freehand markings on printed images are acceptable, provided they are clear and unambiguous. Image mark-ups shall be clear in their intent or color-coded).

8.4.4 VERIFICATION

Verification is the independent examination by a competent examiner to ensure that the original examiner came to a valid conclusion. This is an independent application of the ACE process to either support or refute the conclusions of the original examiner.

All identifications shall be verified by two competent examiners. All exclusions need only be verified by one competent examiner.

If the verifier believes that another conclusion would be more appropriate they will discuss the conclusion with the examiner. However, all erroneous identifications or exclusions will first be reported to the examiner's supervisor.

Conflict resolution shall take place in accordance with the CLD Quality Manual if the original conclusion is contested and cannot be resolved through consultation.

Documenting Verifications

If the verifier determines the conclusion of the primary analyst is valid, the verifier will annotate their initials and the date the conclusion was verified on the Latent Print Verification worksheet. If the verifier uses different exemplars than the analyst, those exemplars must be retained in the case file and documented on the Latent Print Verification Worksheet by the verifier.

If the verifier comes to a different conclusion then the primary analyst then documentation supporting the verifier's conclusion will be retained in the case record.

9.0 REPORTING

The report should be as clear and concise as possible to facilitate understanding by the customer. While the use of standardized wording may be desirable, it is not a priority over clear and concise reporting, nor does it adequately deal with all situations. The responsibility for the writing resides with the author.

The report may be written in JusticeTrax LIMS using the analytical module. Microsoft Word may also be used to create the report, providing the report header contains the relevant information from the RFLE in a format similar to the module-created report. Refer to the CLD LIMS Operations Manual.

Results and/or conclusions of all significant analyses for each item of evidence and/or each comparison must be addressed in the report. Significant analyses are those that are expected to provide meaningful and relevant information to the reader of the report as determined by the analyst based on the case history. In addition to the CLD Operations Manual, Section 4.3.2, the report must address the following main categories, if applicable:

1. Impressions of value developed by processing or lift card analysis. Impressions of value may not always be overtly reported if more significant results are stated. For example, a sentence stating “the latent print has been identified to”, “has been searched through AFIS”, “compared to ____”, etc. assumes the print is of value.
2. Comparisons done— address subjects compared. In instances where some latent impressions are individualized to a subject while other latent impressions are compared and not individualized to the same subject, the report will indicate which specific latent impressions were compared but not individualized. If an impression is individualized, it is assumed to be negative to all other subjects.
3. AFIS— impression suitability, search results, registration
4. Information needed to complete case (such as better exemplars)
5. Final disposition of evidence following completion of case if evidence is not returned with the report (for example, items for DNA analysis to be transferred to another lab instead of returned directly to agency)
6. Laboratory generated digital images, latent lift cards, or other evidence

Latent print processing methods may be described in detail or summarized as needed. However, since the conclusions of analyses are the primary topic of the report, reporting processing methods may be omitted at the analyst’s discretion. A general statement may be used, such as: The (item) was processed by the analyst for latent impressions.

All lifts and photos obtained from evidence items must be accounted for in the worksheets; however, the impressions in the lifts and photos are the primary result and should be reported as such. For example, four photos may be taken of the same impression on an item with different lighting, f-stops, etc. Three lifts may then be taken of the same area. While there is one impression at issue, the report should reflect the emphasis on the impression, instead of using multiple photo numbers and lift numbers.

9.1 TERMINOLOGY

Terms accepted by SWGFAST (Scientific Working Group on Friction Ridge Analysis, Study and Technology) are generally encouraged for usage in reports at the analyst’s discretion.

10.0 AUTOMATED BIOMETRICS IDENTIFICATION SYSTEM (ABIS)

ABIS is a computerized system used in the Latent Print discipline primarily to search suitable unidentified latent finger and palm prints against on-file finger/palm print records. After input of a latent print, biometric identification systems return a list of candidate exemplar images for review. If a search has a positive result, exemplars will be obtained for further analysis as Identifications are made after comparing the actual latent print (or appropriate resolution images) and the exemplar print. A candidate list that does not yield a positive result does not infer a conclusion.

WSP is a member of the Western Identification Network (WIN), a consortium of several western states, referred to as central sites, sharing a common ABIS database. WSP contracts with WIN to operate our database and ABIS software. In addition to the central site members of WIN, access may be provided to other state and local databases through the WIN network (e.g. California DOJ, and the FBI's IAFIS.).

10.1 REFERENCES

The current software instructions, vendor training materials, and guidelines can be consulted for system operating instructions and best practices as necessary.

The following documents are located on the Western Identification Network Training Reference Library internet page:
(http://secure.winid.org)

- WIN 2008 AFIS Latent Best Practices
- WIN 2008 Latent Inquiry Quick Reference Guideline
- NEC User Guides
- NEC Core and Axis

The following document is located on the ABIS computer terminals.

- IBW Latent User Guide

10.2 DEFINITIONS AND TERMS

DATABASES: Various databases available to the Latent Prints discipline for searching latent prints. For example WIN, CAL-DOJ, and IAFIS/NGI.

CANDIDATE: An individual's finger or palm print record under consideration for comparison to the latent print.

DESTINATION: The database (i.e. Washington, WIN, ESSO sites, IAFIS) or database section searched [i.e., LI/LR single (S) Washington (WA)].

ESSO (External Search System Other): ESSO's are other databases that are searchable through the WIN system but are not part of the WIN or IAFIS system.

IAFIS/NGI: Integrated AFIS/Next Generation Identification (FBI AFIS programs)

Integra ID: NEC ABIS software

LI: Latent Inquiry

LR: Latent Registration in the Unsolved Latent Database

NEC: Current vendor for WIN

TLI: Ten-print to Latent Inquiry – ABIS function that performs a search of all ten fingerprints input against the finger portion of the Unsolved Latent Database.

TLI-P: ABIS function that performs a search of palm prints input against the palm portion of the Unsolved Latent Database.

ULW: Universal Latent Workstation, FBI IAFIS latent input software

10.3 ABIS QUALITY IMPRESSION/SUITABILITY

Not all latent prints are useful for ABIS searching. The following criteria will be used to determine if impressions contain sufficient quality to be considered for routine search of ABIS databases. Sufficient quality means that the impression contains the appropriate information to maximize the ABIS's ability to search the database and provide the closest matching candidates. The purpose of these criteria is not to restrict the analyst from searching latent prints that do not meet the criteria. These criteria serve as a guideline to maintain efficient use of the system.

1. The core and axis of a fingerprint, or distal orientation for a palm print, are reliably determined.
2. There are a minimum of 10 encodable (system acceptable) minutiae.
3. The pattern type of a fingerprint is reliably determined to within one reference pattern.

Unidentified latent prints will be assessed for ABIS quality and noted, unless not needed due to lack of investigative necessity.

10.4 ABIS SEARCH, REGISTRATION, AND DOCUMENTATION

Impressions will be searched through ABIS databases as described in the Integra-ID™ IBW Latent User Guide. The initial search should be limited in scope to Washington known records followed by search of the remaining known records in the WIN database, as appropriate.

An analyst uses their discretion evaluating case circumstances to determine the extent to search WIN and other external databases. However, in addition to the WIN database, impressions from cases of crimes against persons will also be searched in the Federal Bureau of Investigation's IAFIS database.

Analysts should use their knowledge of fingerprints and the ABIS databases to maximize the likelihood of a potential match. Permutations of searches may be needed due to the attributes of a latent print or to ensure database penetration.

A negative result means that no matching print was located in the searched database; it does not mean that no matching print exists in the database. An ABIS search with negative results will not be verified. Impressions searched with negative results will be registered (unless later identified).

10.4.1 ABIS CASE DESCRIPTION INFORMATION

When entering a new case into the IBW the following information will be entered:

1. An ABIS case number. The laboratory case number will be incorporated into the ABIS case number. The laboratory case number follows the state and originating agency codes.
    - For example, the ABIS case number for laboratory case number 555-1234, searched from Olympia, would be WA0155501234, or if searched from Cheney, would be WA1755501234.
2. Date of crime
3. Crime code (e.g. 0001 through 0014)

10.4.2 DOCUMENTING ABIS SEARCHES AND REGISTRATION

For each impression searched the following will be documented and/or retained in the case notes:

- Search results (e.g. ‘hit’ or ‘no-hit’)
- Printed “Verification Report” (post ‘Decision’ for hits)
- For WA/WIN searches with negative results: print screen clip of the top six candidate images (multi-rank button) for fingers, top one candidate for palms. For negative FBI and ESSO searches, print the top one candidate.

A reason will be documented in the case notes for an impression searched but not registered (unless identified).

10.5 TENPRINT TO LATENT INQUIRY (TLI)/UNSOLVED LATENT DATABASE

Registered latent print impressions are automatically searched against newly submitted known exemplar records as they are added to the ABIS database. Analysts are responsible for periodically reviewing (at least monthly) the electronic TLI notices. If a TLI search produces a possible candidate, the analyst will contact the agency who submitted the previously registered impression to determine if further action is necessary.

Registered impressions may be deleted from the system manually or automatically due to the impression being identified, by agency request, or the case exceeding statute of limitations.

10.6 ABIS PERFORMANCE CHECK

A WIN/NEC developed performance check will be performed quarterly by the LP Technical Lead, LP Supervisor, or a designated individual. This test verifies that all components of the system, including matching algorithms, are operating within WIN standards. The supervisor will be notified if a performance check does not return the expected result.

The following procedure will be used for performing the performance check (at least one QA print will be searched from each terminal):

1. From the LCMS screen import the WIN QA print (d1.lex, d2.lex, w1.lex, or w3.lex).
    a. Enter an ABIS case number that incorporates the date following the state, originating agency code, and the two letters PC (for performance check).
        - For example WA01PC010215
    b. Enter an evidence number (e.g. E1)
    c. Enter the latent number (e.g. PCW1)
    d. Click the check to enter the case
2. While still in the LCMS screen select the case and the imported latent number, followed with selecting latent inquiry
    a. Enter in the appropriate information (indicated below) for the QA print selected for search.
        - D1 – enter the sex as female and pattern type as scar, no other changes
        - D2 – enter the sex as female and pattern type as scar, no other changes
        - W1 – enter the pattern type as right slant loop, no other changes
        - W3 – enter the pattern type as right slant loop, no other changes
    b. Submit the search
    c. Check the results are consistent with the expected results listed below
        - D1 and D2 - UUF1234567
        - W1 and W3 – UUQ0000003
3. Document the results of the Performance Check on the Latent Print Section ABIS Quality Control Log
4. The job will then be killed and purged from the IBW job queue.

11.0 APPENDIX A– MASTER CARD REQUEST PROCEDURES

NOTE: Archive card prints do not need to be returned to the Ten-print Unit unless MASTER is written in the top right hand corner of the card.

11.1 PURPOSE

Provide the Crime Laboratory Division and Criminal Records Division (CRD) a tracking method for checking out and returning master cards to the CRD Ten-print Unit.

11.2 PROCEDURE

CHECK-OUT

The Forensic Scientist (FS) will enter the master card request onto the Latent- Ten-print Request Excel sheet for the current month and year. The Latent- Ten-print Request Excel yearly workbook will be located on the CRD server:
\\wspgpolycrd1\WP_Data\SHARED\Tenprint Unit\Latent-Tenprint requests

The requesting FS will complete the Latent-Ten-print Request Excel sheet as follows:

a. SID number
b. Subject Name
c. Date of Birth for Subject
d. Requesting Forensic Scientist's name
e. Latent Prints Laboratory case number

There will be two expanding file folders which will be rotated between Ten-print and the Latent Prints Lab. Daily, after 1200, the Property & Evidence Custodian (P/EC) or FS will hand-carry the expanding file to the Ten-print Unit and exchange it for the expanding file containing master cards pulled from the previous day's requests. The Ten-print expanding file will be located on a table at the OA3 desk next to the incoming mail tray.

The OA3 will check the Latent-Ten-print Request Excel sheet on the Shared Drive by 1200 daily and perform the following steps:

1. Print a copy of the current Latent-Ten-print request list. *Highlight the entries to be printed and remember to check "print selection" to avoid printing the entire list. (Select File, Print, Print Selection, OK).

2. Create a check-out card for SID numbers lower than WA2233199-2. Indicate on the check-out card it is for the Latent Unit. Pull master cards from the Lektrievers and replace with check-out cards. Note on the printout the card has been pulled.
    a. In the event of an invalid SID the OA3 will perform a name and date of birth check, with the information provided, in an attempt at locating the correct SID. If the correct SID is located the OA3 will update the SID on the Latent-Ten-print request list.
3. When all masters have been pulled, give the printout to a Fingerprint Technician who will card print the Archive Primary record for requests with SID numbers higher than WA2233199-2. The Technician will retrieve the printed cards,

stamp with Archive stamp, and note on the print out a card print has been made. The Technician will deliver the card prints and the print-out to the OA3. If there is no Archive record for a request, the Technician will advise the OA3. The OA3 will check the Lektriever for a filed Master Card from Archive and follow step 2.

4. The OA3 will update the Excel spreadsheet for all cards retrieved by entering the date and their initials. "Master" will be entered in the Card Type column for all master cards. This will provide a tracking method for master card returns.
5. The pulled master cards and archive card prints will be placed in the expanding file behind the requesting scientist's name. A P/EC or FS will retrieve the file the following day exchanging it for the other expanding file.

RETURN

After case completion, the requesting FS will return the master fingerprint card(s) by placing them in the expanding file under the section labeled Master Card Returns.

1. Daily, the P/EC or FS will hand carry the expanding file containing the master cards being returned to the CRD Ten-print Unit and exchange it for the other expanding file at the OA3's desk.

2. The OA3 will process the returned masters by entering the return date and their initials in the appropriate columns on the Latent–Ten-print Request Excel sheet. The masters will then be filed in the Lektriever or placed in the To Be Filed tray.

MONITORING

In the event the Latent Prints Lab needs to retain a master fingerprint card for longer than (1) one month, the lab supervisor will notify the Ten-print Unit and provide an estimate for how long the master fingerprint card will be checked out. The Ten-print Unit staff is responsible for contacting the Latent Prints Lab when a master fingerprint card has been out for longer than (1) one month without prior arrangement.

MAINTENANCE

The Latent-Ten-print Request Excel yearly workbook will be located on the CRD server. It will be maintained by the Forensic Scientist, at the Latent Prints Laboratory, serving as AFIS Coordinator. The worksheet will remain password protected to prevent file error or accidental corruption. The password will be kept by the Latent Prints Laboratory and Fingerprint managers along with the personnel responsible for maintenance.

12.0 APPENDIX B- FORMULARIES

For additional latent print processing development formulations, the examiner can refer to the following established texts:

- The Manual of Fingerprint Development Techniques, Home Office, SRDB
- Chemical Formulas and Processing Guide for Developing Latent Prints, U.S. Department of Justice, FBI

Note: Recipes may be scaled as appropriate without changing the ratios.

Exact measurements and proportions when preparing chemical solutions are desirable for consistent quality, but successful results in developing latent fingerprints are not dependent upon unequivocal accuracy.

Safety: Wear appropriate lab coat and gloves when mixing or using the following processes. Chemicals should be used in a fume hood, well-ventilated area, or outside. For additional safety procedures, see Latent Prints Technical Manual, Section 5.0.4; MSDS; Merck Index; or similar.

12.1 ACID YELLOW

EQUIPMENT:

scales, beakers, graduated cylinder, magnetic stirrer and stirring bar or other stirring device, clear or dark storage bottles

REAGENT PREPARATION ([1]):

- Acid Yellow 7:

1g Acid Yellow 7
50mL Acetic Acid (Glacial, 98%)
250mL Ethanol (98% or higher)
700mL demineralized or distilled water

* Preferably use an Erlenmeyer flask for preparation of the Acid Yellow 7 solution. Add water first and dissolve the Acid Yellow 7 powder in the water by swirling the flask or using a magnetic stirrer and a PTFE-covered stir bar. The powder will dissolve quickly. Then add ethanol and acetic acid (order not important).

- Blood Fixative:

20g 5-Sulfosalicyclic acid, dihydride
1000mL demineralized or distilled water

* Add components to a beaker/flask of sufficient size and mix till complete dissolution, using a magnetic stirrer.

- Wash Solution

50mL Acetic Acid (Glacial, 98%)
250mL Ethanol (98% or higher)
700mL dimineralized or distilled water

12.2 AMIDO BLACK

CHEMICALS:

Naphthol Blue Black; Glacial Acetic Acid; Methanol; Citric Acid acid, citric acid monohydrate; Kodak Photo Flo 200 Solution; Water-based fixative solution

EQUIPMENT:

scales, beakers, graduated cylinder, magnetic stirrer and stirring bar or other stirring device, clear or dark storage bottles

MIXING PROCEDURE 1 (METHANOL BASE)

* Use butyl rubber gloves.

Amido Black is mixed in two solutions: Developing and De-staining. In addition, there is a final rinse of distilled water.

Developer solution:

2 g Naphthol Blue Black
100 mL Glacial Acetic Acid
900 mL Methanol

Combine the above and mix on a stir plate until all the Naphthol Blue Black is dissolved (approx. 30 minutes).

De-staining solution:

100 mL Glacial Acetic Acid
900 mL Methanol

Final rinse solution:

Distilled water is preferred; however, tap water may be used.

MIXING PROCEDURE 2 (WATER BASE)

Amido Black water base formula consists of a fixative, citric acid stock, developer, and rinse solutions.

Fixative solution:

20 g 5-Sulphosalicyclic Acid
1000 mL distilled water

Combine the above and mix on a stir plate until the acid is dissolved.

Citric Acid stock solution:

38 g Citric Acid
2 L distilled water

Combine the above and mix on a stir plate until the citric acid is dissolved.

Developer solution:

1 L Citric Acid stock solution
2 g Naphthol Blue Black
2 mL Kodak Photo Flo 200 Solution

Place the liter of citric acid stock solution onto a stirring device. Slowly add 2 grams of Naphthol blue black and stir for approximately 30 minutes. Add the Photo Flo 200 and stir lightly.

Rinse solution:

1 L Citric Acid stock solution

STORAGE:

clear or dark bottles

SHELF LIFE:

indefinite

MAINTENANCE OF EQUIPMENT:

Wash all containers in mild detergent and rinse thoroughly with water.

12.3 ARDROX P-133D

CHEMICALS:

Ardrox P-133D, Methanol, HFE-7100

EQUIPMENT:

- beaker,
- graduated cylinder,
- dark storage bottles

SAFETY:

few safety hazards. Methanol is readily absorbed through the skin to cause the same effects as inhalation as well as optic nerve damage and gastrointestinal problems. Use butyl rubber gloves to protect against the components of this mixture when using methanol as the diluent.

MIXING PROCEDURE:

Ardrox P-133D does not have to be dissolved in any type of carrier; however, it may be diluted if preferred.

Ardrox:

bottle strength

Ardrox P-133D stock solution:

2 mL Ardrox P-133D
1 L Methanol or HFE-7100

Alternate Stock Solution:

- 2 mL Ardrox P-133D
- 10 mL Acetone
- 25 mL Methanol
- 10 mL 2-Propanol
- 8 mL Acetonitrile

- 945 mL Petroleum Ether

STORAGE:

store in original container

SHELF LIFE:

indefinite

MAINTENANCE OF EQUIPMENT:

Wash in mild detergent and rinse thoroughly with water.

12.4 BASIC YELLOW 40

CHEMICALS:

Ethanol, Photo-Flo, Basic Yellow 40, Water

EQUIPMENT:

scales, beakers, graduated cylinder, magnetic stirrer and stirring bar or other stirring device, clear or dark storage bottles

SAFETY:

Basic Yellow is a harmful irritant

MIXING PROCEDURES:

Water based:

- 1 g Basic Yellow 40
- 1 L water
- 2 mL Photo-Flo

Ethanol based:

- 2 g Basic Yellow 40
- 1 L Ethanol

12.5 DFO (1,8-DIAZAFLUOREN-9-ONE)

CHEMICALS:

DFO, Methanol, Glacial Acetic Acid, HFE-7100

EQUIPMENT:

scales, graduated cylinder, magnetic stirrer and stirring bar or other stirring device, dark storage bottles, oven or iron forensic light source

SAFETY:

HFE-7100 poses little flammability concerns with low overall toxicity. Glacial acetic acid is strongly irritating to eyes, nose, and throat and can cause skin burns upon contact. Both acetic acid and methanol are incompatible with strong oxidizers. Methanol is a flammable liquid and acetic acid is combustible. Methanol vapors irritate the eyes, nose, skin, and lungs and cause headache, drowsiness, and dizziness. Methanol is readily absorbed through the skin to cause the same effects as inhalation as well as optic nerve damage and gastrointestinal problems. Use butyl rubber gloves to protect against the components of this mixture.

MIXING PROCEDURE:

Combine the ingredients and stir on a stirring device for approximately twenty minutes, until the DFO is dissolved. Place in a dark bottle.

HFE-7100 working solution:

- 0.25 g DFO
- 40 mL Methanol
- 20 mL Acetic acid
- 940 mL HFE-7100

STORAGE:

Store solutions in dark bottles. The working solution should be stored in a refrigerator.

SHELF LIFE:

more than six months

MAINTENANCE OF EQUIPMENT:

Wash all containers in mild detergent and rinse thoroughly with water.

12.6 GENTIAN VIOLET (CRYSTAL VIOLET)

CHEMICALS:

- Gentian
- Violet, Kodak
- Photo-Flo

EQUIPMENT:

- scales,
- beakers,
- magnetic
- stirrer and stirring bar or
- other stirring device,
- storage bottles,
- dry mounting press

SAFETY:

The chemicals used are low hazard and toxicity. The hazards are skin, respiratory system, and eye irritation, primarily when exposed to the dry gentian violet powder, but potentially with the liquid mixture as well. Ingestion can cause severe gastrointestinal and abdominal distress.

MIXING PROCEDURE:

Gentian Violet stock solution:

- 1 g Gentian Violet
- 1000 mL distilled water

Combine ingredients and stir for approximately twenty-five minutes.

STORAGE:

clear or dark bottles

SHELF LIFE:

indefinite

MAINTENANCE OF EQUIPMENT:

All equipment should be washed thoroughly in a mild detergent and rinsed with water.

12.7 GUN BLUE/ACIDIFIED HYDROGEN PEROXIDE

EQUIPMENT:

- beakers,
- magnetic
- stirrer and stirring bar or
- other stirring device,
- storage bottles

REAGENT PREPARATION:

- Formula 44/40 (Instant Gun Blue)*

1 part reagent to 80 parts distilled water
* Birchwood Casey Super Blue was used.

- Outer's Gun Blue

1 part reagent to 40 parts distilled water

- Acidified Hydrogen Peroxide

14.1ml of 5% household vinegar
20.0ml of 3% household hydrogen peroxide

12.8 1,2-INDANEDIONE

EQUIPMENT:

- scales,
- beakers,
- graduated cylinder,
- magnetic stirrer and stirring bar or
- other stirring device,
- dark storage bottles

SAFETY:

All of the solvents used have the potential to form explosive or flammable vapor concentrations in air and can have respiratory or nervous system effects in high enough concentrations.

REAGENT PREPARATION:

1. 1,2-Indanedione Formula (mix in the following order) ([2])

2 g 1,2-Indanedione
70 mL Ethyl Acetate
930 mL HFE 7100

2. Zinc Chloride Formula ([4])

0.4 g zinc chloride dissolved in
10 mL absolute ethanol, then add
1 mL ethyl acetate, then dilute with
190 mL HFE-7100 carrier

3. 1,2-Indandedione + Zinc Chloride Formula ([4])

Add 2mL of the zinc chloride solution to
100mL of the indanedione solution

12.9 NINHYDRIN

CHEMICALS:

Ninhydrin, Methanol, Petroleum Ether, Isopropyl Alcohol, Acetone, HFE-7100

EQUIPMENT:

- scales,
- beakers,
- graduated cylinder,
- magnetic stirrer and stirring bar or
- other stirring device,
- dark storage bottles,
- humidity chamber or
- steam iron

SAFETY:

All of the solvents used have the potential to form explosive or flammable vapor concentrations in air and can have respiratory or nervous system effects in high enough concentrations. Petroleum ether is a flammable liquid of moderate volatility. When inhaled, it will irritate the eyes, nose and throat and can cause central nervous system depression at high enough concentrations. It is irritating to the skin and will cause drying, cracking, and dermatitis. Nitrile rubber gloves are most effective. Acetone is a flammable liquid of moderate volatility. It is incompatible with oxidizers and acids. It is irritating to the eyes, nose, and throat, and can cause headache, dizziness, and depression of the central nervous system in high enough concentrations. It will cause dermatitis with prolonged or repeated contact. Butyl rubber or neoprene/butyl rubber gloves are most effective.

MIXING PROCEDURES:

Ninhydrin (Petroleum ether carrier):

The petroleum ether carrier will not dissolve the Ninhydrin crystals. They must be dissolved in methanol. This formula will yield a 0.8% solution.

4 grams	Ninhydrin
20 mL	Methanol

480 mL	Petroleum ether

The Ninhydrin crystals are first dissolved in methanol. The petroleum ether is added but it will not mix with the methanol. Pour off the top liquid and save. This is the solution you will use. The small amount of liquid that is left can be disposed of.

5 grams	Ninhydrin
30 mL	Methanol
40 mL	Isopropyl Alcohol
930 mL	Petroleum ether

The Ninhydrin crystals are first dissolved in methanol. The isopropyl alcohol is then added followed by the petroleum ether. This formula will yield a 0.5% solution.

Ninhydrin (Acetone carrier): This formula will yield a 0.6% solution. (NOTE: Not to be used on items containing either mechanical or handwritten inks.)

6 grams	Ninhydrin
1000 mL	Acetone

The Ninhydrin crystals will dissolve readily in acetone. Minimal stirring is required.

Normal working concentrations for Ninhydrin are 0.5% to 1.0% (w/v). Other concentrations are warranted on special surfaces when test impressions or an examiner's personal experience indicate that a stronger or weaker solution is appropriate. Percentage concentration tables for weight/volume and weight/weight mixtures of Ninhydrin follow.

NINHYDRIN SOLUTION CONCENTRATION FORMULAS

Weight of Ninhydrin in Grams/Volume of Solution							
VOLUME	0.2%	0.4%	0.5%	0.6%	0.75%	1.0%	1.5%
100 mL	0.2 g	0.4 g	0.5 g	0.6 g	0.75 g	1.0 g	1.5 g
1 pint	0.94 g	1.88 g	2.35 g	2.82 g	3.52 g	4.73 g	7.08 g
1 quart	1.89 g	3.78 g	4.73 g	5.67 g	7.09 g	9.46 g	14.19 g
1 liter	2.0 g	4.0 g	5.0 g	6.0 g	7.5 g	10.0 g	15.0 g
1 gallon	7.57 g	15.14 g	18.92 g	22.71 g	28.38 g	37.85 g	56.77 g

Weight of Ninhydrin in Grams/Weight of Ethyl Ether							
Weight	0.2%	0.4%	0.5%	0.6%	0.75%	1.0%	1.5%
1 lb	0.90	1.81	2.26	2.71	3.39	4.53	6.79
2 lbs	1.81	3.62	4.53	5.44	6.80	9.07	13.60
3 lbs	2.72	5.44	6.80	8.16	10.20	13.60	20.40
4 lbs	3.62	7.25	9.07	10.88	13.60	18.14	27.21
5 lbs	4.53	9.06	11.33	13.60	17.00	22.67	34.00

STORAGE:

Ninhydrin solutions should be stored in dark containers. When Ethyl Ether is used as the solvent, the solution should be stored in a refrigerator.

SHELF LIFE:

Up to one year

MAINTENANCE OF EQUIPMENT:

Wash all equipment in a mild detergent and rinse with water.

HFE-7100 CARRIER

MIXING PROCEDURE:

This formula will yield a 0.5% solution.

Ninhydrin	5 g
Ethanol	45 mL
Ethyl Acetate	2 mL
Acetic Acid	5 mL
HFE-7100	1 L

The Ninhydrin crystals are first dissolved in ethanol. The ethyl acetate and acetic acid are then added followed by the HFE-7100. The two-phase/"oily" aspect of this solution can easily be eliminated without detriment to final solution via use of a laboratory separatory funnel. This additional procedure will dispose of the heterogeneous residual. Once separated, there is minimal problem with subsequent esterification, or the reappearance of the second phase and associated Ninhydrin precipitate.

STORAGE:

Store in dark containers

SHELF LIFE:

Stable between 0°-35°C in excess of three months

MAINTENANCE OF EQUIPMENT:

Wash all equipment in a mild detergent. Rinse with water.

12.10 NINHYDRIN SOLUTION (THERMAL & CARBONLESS HFE-7100)

SAFETY:

HFE-7100 poses few flammability concerns with low overall toxicity. Petroleum ether and heptane are flammable liquids of moderate volatility. When inhaled, they will irritate the eyes, nose and throat and can cause central nervous system depression at high enough concentrations. Each is irritating to the skin and will cause drying, cracking, and dermatitis. Nitrile rubber gloves are most effective as protection for the hands.

PURCHASE:

NinhydrinHT

STORAGE:

Store in dark containers and/or in a dark area

MAINTENANCE OF EQUIPMENT:

Wash all equipment in a mild detergent. Rinse with water.

12.11 OIL RED O

CHEMICALS

Oil Red O, Methanol, Sodium Hydroxide, Distilled Water, Sodium Phosphate Monobasic Monohydrate, Sodium Phosphate Dibasic Heptahydrate

EQUIPMENT

Scales, beakers, graduated cylinders, flasks, magnetic stirrer and stirring bar or other stirring device, dark storage bottles, titer plate shaker

SAFETY

Hazardous in case of ingestion. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of inhalation. May be combustible at high temperature.

MIXING PROCEDURE:

Stain Solution:

1. Weigh out 1.54 g of ORO and dissolve it in 770 ml of methanol.
2. Dissolve 9.2 g of NaOH (sodium hydroxide) in 230 ml of distilled water and add it to the above solution.
3. Mix and filter, then store in a brown bottle away from light.

pH 7 Buffer Solution:

1. Add 101.55 g of $NaH_2PO_4 \cdot H_2O$ (sodium phosphate monobasic monohydrate) to 1 L of distilled water and shake or stir until it is dissolved.
2. Add 338.79 g of $Na_2HPO_4 \cdot 7H_2O$ (sodium phosphate dibasic heptahydrate) to 1 L of distilled water and shake or stir until it is dissolved. Application of low heat will speed dissolving process.
3. Mix the two solutions.
4. Add enough distilled water to increase volume to 4 L.

STORAGE

Dark bottles

SHELF LIFE

Indefinite

MAINTENANCE OF EQUIPMENT:

Wash all containers in mild detergent and rinse thoroughly with water.

12.12 PHYSICAL DEVELOPER (PD)

EQUIPMENT:

- beakers,
- graduated cylinder,
- magnetic stirrer and stirring bar or

- other stirring device

SAFETY:

The solutions made consist of several strongly irritating and corrosive chemicals. Ferric nitrate and silver nitrate are both oxidizers and will cause burns and irritation upon contact. Pay close attention to label warnings and wear long cuffed nitrile, butyl, viton, or neoprene gloves to avoid skin contact, particularly when working with the dry chemicals. Contact lenses should not be worn when working with chemicals.

MIXING PROCEDURE 1:

Physical Developer Kit (Lightning Powder Co.)

CHEMICALS:

Solution A (20% Silver Nitrate solution), Solution B (Reductant solution)

Working Solution:

- 5 mL Solution A
- 90 mL Solution B

Combine the two solutions and stir for 1 minute a short time prior to use.

STORAGE:

Store in a refrigerator (do not freeze) and keep out of sunlight

SHELF LIFE:

Working solution: one to two days. Solutions A and B: six months

MIXING PROCEDURE 2:

PD uses a Working Solution (utilizing Solutions A and B), a Stock Solution, and a Maleic Acid Solution

CHEMICALS:

- Ferric Nitrate,
- Ferrous Ammonium,
- Citric Acid,
- Silver Nitrate,
- n-Dodecylamine acetate,
- Synperonic N,
- Maleic Acid

EQUIPMENT:

- scales,
- beakers,
- graduated cylinder,
- magnetic stirrer and stirring bar or
- other stirring device,
- dark storage bottles

Working Solution: protect from direct sunlight

Solution A:

- 50 mL Distilled water
- 10 grams Silver Nitrate

Add the distilled water to the silver nitrate while stirring with a magnetic stirrer. Stir for one minute and place in a dark bottle.

Solution B:

- 900 mL Distilled Water
- 30 grams Ferric Nitrate
- 80 grams Ferrous Ammonium Sulfate
- 20 grams Citric Acid

Add the solids to the distilled water and stir until all have dissolved and then stir for an additional five minutes.

Stock Solution:

- 1 L distilled water
- 4 grams n-Dodecylamine Acetate
- 4 grams Synperonic

Place distilled water into a two liter bottle. Add the n-Dodecylamine acetate while stirring with a magnetic stirrer. Add the synperonic to the solution and stir for at least thirty minutes. Transfer this solution (along with any solid matter) into a one liter storage bottle.

Add forty ml of the Stock Solution to Solution B. After verifying that all the crystals in Solution A are dissolved, add this entire amount to the combination solution you have just made. This is your processing solution.

Maleic Acid:

- 1 L distilled water
- 25 g Maleic Acid

Add the Maleic acid to the distilled water while stirring with a magnetic stirrer.

STORAGE:

- Solution A- dark bottle in dark refrigerator
- Solution B- dark bottle in dark cupboard
- Stock Solution- dark bottle, room temperature

Maleic Acid Solution- dark bottle, room temperature

SHELF LIFE:

- Solution A - twenty-four hours
- Solution B - several weeks
- Stock Solution - indefinitely

Maleic Acid Solution - indefinitely

MAINTENANCE OF EQUIPMENT:

Wash all containers in mild detergent and rinse thoroughly. Do not use abrasives on any glassware items.

12.13 POWDERS

Many commercially produced latent print "dusting" powders are available and many are very similar from company to company. No powder is universally applicable to all types of non-porous surfaces and most examiners need a stock of a variety of types and colors of powders for specialized applications. While such powders are usually commercially procured, some examiners prefer to prepare a portion of their stock powders. Some of the common formulas for such preparation are listed below.

Powder stocks may be purged of unwanted contaminates or large powder particles by sifting them through a number 60 sieve or using a mortar and pestle. Storing powder in sealed containers and out of excessively humid conditions will reduce the need for such purging. Using a mortar and pestle to grind commercial powders (especially magnetic powders) can improve their fine consistency

SAFETY:

Powders may be harmful over long periods of time if inhaled. Dusting with powder should occur in a fume hood or in a well-ventilated area. If ventilation is not optimal, a face mask will reduce inhalation.

EQUIPMENT:

jar of fingerprint powder; fingerprint brushes – fiberglass, short bristle brush, or feather duster; container to hold powder – shallow dish, lid, or lab weighing dish; lifting tape (or other lifting device) – clear, frosted, or polyethylene; lift cards – smooth index stock or commercial lift cards; flashlight, alternate light source, or good overhead lighting

POWDER FORMULAS:

- Black Powders:
- Ferric Oxide Base:
- 10 parts black magnetic ferric oxide
- 5 parts rosin
- 5 parts lampblack
- Lampblack Base:
- 10 parts lampblack
- 4 parts rosin
- 3 parts Fuller's earth
- Manganese Dioxide Base:
- 10 parts manganese dioxide
- 5 parts ferric oxide, black magnetic
- 5 parts lampblack
- 3 parts rosin

Gold Powder:

10 parts pale gold lining
5 parts rosin

Gray Powder:

4 parts Chemist's gray
1 part aluminum fine lining

Orange Powders:

5 parts red lead oxide
5 parts rosin
5 parts Fuller's earth
15 parts acacia powder
or
5 parts red lead oxide
15 parts rosin

Red-brown powders:

Cuprous Oxide Base: 10 parts red cuprous oxide
5 parts basic lead carbonate

Ferric Oxide Base:

5 parts red ferric oxide
5 parts rosin

Mercuric Sulfide Base:

5 parts red mercuric sulfide
10 parts rosin

White Powders:

Titanium Dioxide Base:
10 parts titanium dioxide
5 parts basic lead carbonate
5 parts rosin

Lead Carbonate Base:

5 parts basic lead carbonate
3 parts titanium dioxide
2 parts gum Arabic

Mixed White:

5 parts titanium dioxide
5 parts basic lead carbonate
5 parts gum Arabic

12.14 R.A.M.

CHEMICALS:

Ardrox P-133D, Rhodamine 6G, MBD, Methanol, 2-Propanol, Acetonitrile, Petroleum Ether

EQUIPMENT:

scales, beakers, graduated cylinder, magnetic stirrer and stirring bar or other stirring device, dark storage bottles, alternate light source

SAFETY:

The Rhodamine 6G within RAM is classified as a suspect animal carcinogen, but sufficient evidence of human carcinogenicity has not been established. Inhalation of the mist and procedures that generate excessive mist are to be avoided. Ardrox P-133D presents few safety hazards when properly used in its neat form. Methanol vapors irritate the eyes, nose, skin, and lungs and cause headache, drowsiness, and dizziness. Methanol is readily absorbed through the skin to cause the same effects as inhalation as well as optic nerve damage and gastrointestinal problems. Petroleum ether is a flammable liquid of moderate volatility. It is irritating to the skin and will cause drying, cracking, and dermatitis. Nitrile rubber gloves are most effective as protection for the hands. Wash bottle type rinsing should be used in lieu of aerosol mist. If heat fuming is required, then this should occur under a fume hood. Use butyl rubber gloves to protect against the components of this mixture.

MIXING PROCEDURES:

Working Solution:

- Stock Solution #1 (below) 3 mL
- Stock Solution #2 (below 7 mL
- Ardrox P-133D (below) 2 mL
- Methanol, liquid 20 mL
- 2-Propanol, liquid 10 mL
- Acetonitrile, liquid 8 mL
- Petroleum Ether, liquid 950 mL

Combine ingredients in the order listed and store in a dark bottle. Shake solution in bottle vigorously every thirty days. All of the ingredients for R.A.M., excluding the petroleum ether, may be mixed and stored. When ready to mix the working solution, simply add the petroleum ether.

Stock Solution #1:

Rhodamine 6G - 1 gram
Methanol - 1000 mL

Stock Solution #2:

MBD - 1 gram
Acetone - 1000 mL

Stock Solution #3:

Ardrox P-133D

STORAGE:

Store in a dark bottle

SHELF LIFE:

Indefinite

12.15 RHODAMINE 6G

CHEMICALS:

Rhodamine 6G, Methanol

EQUIPMENT:

- scales,
- beakers,
- graduated cylinder,
- magnetic stirrer and stirring bar or
- other stirring device,
- dark storage bottles

SAFETY:

Rhodamine 6G is classified as a suspect animal carcinogen, but sufficient evidence of human carcinogenicity has not been established. At relatively high levels of ingestion or absorption through the skin, it does cause chronic toxic effects in several body organs. Inhalation of the mist and procedures that generate excessive mist are to be avoided. Methanol vapors irritate the eyes, nose, skin, and lungs and cause headache, drowsiness, and dizziness. Methanol is readily absorbed through the skin to cause the same effects as inhalation as well as optic nerve damage and gastrointestinal problems. Wash bottle type rinsing should be used in lieu of aerosol mist. If heat fuming is required, then this should occur under a fume hood. Use butyl rubber gloves to protect against the components of this mixture.

MIXING PROCEDURES:

Combine ingredients for Stock Solution and place on a stirring device until all the Rhodamine 6G is thoroughly dissolved.

Stock Solution:

1 g Rhodamine 6G
1 L Methanol

Working Solution:

5 mL Rhodamine 6G stock solution
500 mL Methanol

STORAGE:

Stock solution should be stored in a dark bottle

SHELF LIFE:

Indefinite

MAINTENANCE OF EQUIPMENT:

Wash all equipment in a mild detergent and rinse with water.

12.16 SILVER NITRATE

CHEMICALS:

- Methanol,
- Silver Nitrate

EQUIPMENT:

- scales,
- beakers,
- magnetic stirrer,
- graduated cylinder, dark glass storage bottles

SAFETY:

Eye protection should be worn. Methanol is highly flammable and toxic.

MIXING PROCEDURES:

Silver nitrate uses a working solution.

- Weigh out 10 g of silver nitrate. Place in clean, dry, 1 liter, glass beaker.
- Measure out 500 mL of methanol. Add to the silver nitrate while stirring with a magnetic stirrer. Stir until a colorless working solution is produced.
- Transfer working solution into a clean 500 mL, dark glass bottle.

STORAGE:

Store working solution in dark 500 mL glass bottle, in a dark area

SHELF LIFE:

Unused solution will keep indefinitely in the dark

MAINTENANCE OF EQUIPMENT:

Wash all equipment in mild detergent and rinse with water.

12.17 SMALL PARTICLE REAGENT

CHEMICALS:

Molybdenum disulfide, Kodak Photoflo-200, distilled water

EQUIPMENT:

- Beakers,
- glass trays,
- funnel,
- garden spray bottles,
- measuring
- cylinder

SAFETY:

The Molybdenum disulphide powder should not be inhaled. Wear a particulate respirator when handling powder.

MIXING PROCEDURES:

SPR can either be sprayed or used as a bath solution.

Bath working solution:

- 30 g Molybdenum disulphide
- 1 L distilled water
- 2 drops Kodak Photoflo-200

STORAGE:

In its working form, SPR can be stored in labeled spray bottles

SHELF LIFE:

In pre-mixed form, Molybdenum disulfide has indefinite shelf life

MAINTENANCE OF EQUIPMENT:

Beakers, garden bottles and treatment dishes should be kept solely for SPR.

12.18 STICKY-SIDE/POWDER SUSPENSION

CHEMICALS:

Sticky-Side powder kit, Forensic Source (includes Kodak Photoflo-200); Photoflo-200; Molybdenum disulfide or latent fingerprint powder

EQUIPMENT:

Most items needed for the mixture of this reagent are provided within the kit. Glass trays will be needed.

MIXING PROCEDURES:

Sticky-Side Powder: Place about 1 teaspoon of Sticky-Side powder into a shallow jar. Fill brown dropper-bottle half full of Photo-Flo 200 and half full of distilled water. Shake well. Using the dropper, add this solution to the powder in the shallow jar until you have a paste with the consistency of thin paint.

- 1.5 g Molybdenum disulfide or fingerprint powder
- 5 mL Photoflo or liquid dish soap
- 5 mL distilled water

Prepare and utilize in the same manner as Sticky-side Powder. Mix and add powder to achieve appropriate consistency.

STORAGE:

Store all kit items within provided storage box

SHELF LIFE:

Items in pre-mixed state: indefinite. Mixed working solutions should be discarded after each use.

EQUIPMENT MAINTENANCE:

Wash all equipment in a mild detergent and rinse with water.

12.19 SUDAN BLACK

CHEMICALS:

Sudan Black B (solvent black 3), industrial Methylated Spirit, distilled water

EQUIPMENT:

- beakers,
- balance,
- glass tray,
- plastic stirring rod,
- plastic forceps,
- glass storage bottles

MIXING PROCEDURES:

- Weigh out 15g of Sudan Black and place in clean 2L glass beaker
- Measure out 1L of industrial Methylated Spirit and add to beaker. Stir with plastic stirring rod.
- Measure out 500mL of distilled water, add to beaker, and stir. A black working solution will be produced.
- Transfer working solution to a clean, labeled glass bottle

STORAGE:

Labeled dark glass bottle

SHELF LIFE:

Working solution will keep indefinitely

MAINTENANCE OF EQUIPMENT:

Wash all equipment in a mild detergent and rinse with water.

12.20 KJELL CARLSON INNOVATION WETWOP™/WET POWDER SUSPENSION

CHEMICALS:

WetWop™, Forensic Source (black or white) or other re-branded product

EQUIPMENT:

glass tray, camel hair brush, running water

MIXING PROCEDURES:

Follow instructions on container. WetWop™ is ready-to-use and pre-mixed by the manufacturer.

STORAGE: general chemical storage within its own packaging

SHELF LIFE**:**

In pre-mixed state, indefinite

EQUIPMENT MAINTENANCE:

Wash all equipment in a mild detergent and rinse with water

12.21 TAPEGLO™

CHEMICALS:

TapeGlo™, Forensic Source (black or white) or other branded equivalent

EQUIPMENT:

glass tray, camel hair brush, running water

MIXING PROCEDURES:

Follow instructions on container. TapeGlo™ is ready-to-use and pre-mixed by the manufacturer.

STORAGE:

General chemical storage within its own packaging

SHELF LIFE:

In pre-mixed state, indefinite

EQUIPMENT MAINTENANCE:

Wash all equipment in a mild detergent and rinse with water

13.0 APPENDIX C– SUPPLIES, EQUIPMENT & MAINTENANCE

13.1 SUPPLIES

BRUSHES:

A wide variety of types, shapes and sizes of brushes are available for processing evidence with powders. The total supply of different kinds of brushes required in a Latent Print discipline depends on the types of brushes and colors of powders used. An ample number of appropriate brushes will help to preclude cross-contamination of powders and brushes.

Feather Brush-

Generally used for fluorescent powder applications and delicate processing purposes involving the removal of excess powder or soot.

Fiberglass Brush-

Consists of fine fiberglass bristles and is used by many examiners as an all-purpose brush in lieu of several other sizes and types. The primary advantage is the ability to process a large area with considerably less "re-powdering" of the brush than other types. These brushes are more expensive than hair or feather brushes but often last longer than either type.

Hair Brush –

When used these brushes should be very soft and pliable and are appropriate for all powders, except magnetic. Stiff bristles can damage latent impressions, usually by causing light or dark streaks in the latent print. Commercially produced latent print hair brushes are most often made from camel hair. Soft fine brushes are appropriate for applying TapeGlo™, Wetwop™ and sticky side powder.

Magnetic Brush (Wand) - These wands are used only for the application of magnetic type powders (or mixtures of magnetic/conventional powders). In that the "bristles" involved consist of the magnetic powder itself, the applicator head of the wand will not wear out. One magnetic wand will suffice for many colors of powder. Some examiners also use 5 cm and 10 cm wide magnetic brushes for processing large areas. "Self-contained magnetic brushes" include a built-in powder reservoir.

MAINTENANCE:

Brushes may be cleaned with mild detergent and water. Blow drying will help (especially with camel hair brushes) to prevent matting after washing with the soapy solution. Dirty or contaminated brushes cannot always be cleaned to alleviate stiff bristles. Brushes that have been cleaned and still have stiff bristles should not be used for dusting latent prints.

QUALITY:

Adequate for intended use

13.2 CASTING MATERIAL (MIKROSIL OR SIMILAR):

Commercially available silicone rubber or dental/die stone powder may be used for lifting difficult latent impressions from uneven surfaces. Merely mix according to manufacturer's directions and apply to the intended casting area.

Should you need to change a light colored casting medium to dark, you can cautiously add black fingerprint powder to the mixture until the desired shade is achieved. Dark colored silicone rubber is now available.

Quality:

Adequate for use

LIFTING MATERIALS:

Lifting materials for latent fingerprints consist primarily of transparent, opaque, adhesive-coated materials and electrostatic dust lifts. The background color of the opaque lifting medium is dependent upon the color of the impression to be lifted.

Caution must be exercised in utilizing general-purpose tapes (book-binding, etc.) in place of specialized latent print lifting tape or lifts. The reason being that a thick adhesive emulsion base can cause the migration and disappearance of some latent print ridge detail (especially with some light colored powders) either immediately or over a period of days or weeks. Following is a list of recommended tapes and lifts for latent print preservation.

Tape–

Special latent print lifting tape, both transparent and frosted, is available from several commercial sources. They enable direct comparison with inked impressions and can be used with a wide variety of black or white backing materials, including pre-printed backing cards, index cards, photographic papers and vinyl backing tabs. "Vinlon" flexible lifting tape and other black or white rubber tapes may be used in place of rubber lifters for curved surfaces.

Quality: 3M Clear Poly tape, Remco tape, or equivalent

Hinge Lifts –

These consist of a transparent lifting medium (tab) attached to a clear, black or white plastic backing tab. The lifting tab is usually of a less flexible nature than most lifting tapes that sometimes results in white circles surrounding powder particles (especially with magnetic powders). This can be mostly alleviated through the use of a more pliable medium. Lifts of materials similar to hinge lifts are available in sizes suitable for lifting palm prints and footprints.

Quality:

Suitable for use

Rubber Lifts

Available in black or white with transparent covers, the primary advantage is the ability to lift latent impressions from curved surfaces without the creases inherent to tape and hinge lifts. A disadvantage is that the ridge detail must be photographically (or optically as with a prism/mirror viewer) reversed to enable comparison with inked impressions. Rubber lifts are also available in sizes appropriate for lifting entire palm prints and footprints.

Quality:

Suitable for use

Electrostatic Lifting Material –

Electrostatic lifting film for use with the electrostatic lifting kit is available commercially and should be used whenever possible. After photographs have been taken of the current dust impression the film can be wiped clean and used again. Lay the film flat or roll it -never fold as it will permanently crease.

Quality:

Suitable for use

Gelatin Lifts –

These are soft pliable lifts with a moist gelatin like base and can be used for dried mud, dried blood, or dust impressions. They may stand alone or can be used as an adjunct to the electrostatic lift for dust impressions. These are available commercially with black, white, or transparent backgrounds and come in various sizes.
Quality: suitable for use

13.3 POWDERS:

Many commercially produced latent print "dusting" powders are available. No powder is universally applicable to all types of non-porous surfaces and a variety of powders should be available.

Quality

Suitable for use

13.4 MISCELLANEOUS SUPPLIES:

i.e.: lab ware, lab tools, personal protective equipment.

Quality: all items should be of laboratory grade and suitable for the intended use.

13.5 EQUIPMENT

A list of specific equipment is maintained in each laboratory. Specific information as to purchase, calibrations (if necessary), and maintenance for each item is maintained in each laboratory.

13.6 CHEMICAL EXHAUST (FUME) HOODS:

Needed for many latent print chemical mixing and processing techniques. Capture velocity at the open face of the hood should be verified periodically in accordance with department safety manual.

13.7 FUMING CABINETS (CYVAC & PLASTIC TANKS/TENTS):

Several brands are commercially available for latent print applications in the laboratory.

Desirable components include a heating element, one or more glass "windows" to allow observation of development progression, few exposed metal components, and an appropriate lid

to seal the chamber during certain processes. An aquarium, cardboard box, garbage can, etc., may be used provided the chamber can be sealed.

Maintenance: should be conducted on a regular basis according to the manufacturer's specifications. Clean the fumed residue from each cabinet by using the necessary chemicals required for the specific residue. Check for frayed wiring on the heating elements.

13.8 HUMIDITY CHAMBERS:

Humidity chambers are primarily used for post-Ninhydrin processing development where heat and humidity are required.

Ideally, a controlled combination temperature-humidity chamber enables relatively rapid development of post-Ninhydrin processed surfaces with virtually no danger of excessive discoloration or migration that can occur with the use of a steam iron. Normal operating conditions involve 80°F at 80% relative humidity.

In the absence of a specialty chamber, make-shift chambers consisting of a oven with a pan of water may be used. Care must be exercised with such a set-up to preclude contact between an evidentiary surface and water that often condenses (because of a lack of automatic humidity level controls). Both Ninhydrin and the amino acid deposits it reacts with are water soluble.

In lieu of a humidity chamber a steam iron is a viable option. However, care must be taken during use as even careful positioning of the iron above uneven surfaces can result in accidental contact, and thus excessive discoloration at the point of contact. The latent print detail present on unfinished wood can often migrate into the surrounding area of the object when a steam iron is used to expedite processing.

Maintenance: should be in conjunction with manufacturer's specifications.

Heat should not be used on papers with thermally sensitive coatings.

13.9 LIGHT SOURCES AND COMPUTER IMAGE PROCESSORS:

There are commercially available light sources and computer image processors available for any needs described in this manual.

Maintenance: should be in accordance with manufacturer's recommendations.

13.10 MAGNIFYING GLASSES:

Fine quality magnifying glasses are essential to latent print examination work. Usual magnification is approximately 4.5 times.

Headband mounted magnifying glasses are useful during certain processing and examination procedures. These units are commercially available through welding supply dealers and leave both hands free while the examiner manipulates a surface that cannot be placed "under" a conventional fingerprint magnifier.

Maintenance: should be cleaned with commercially available window/lens cleaner. No caustic chemicals should be applied to the lens. It is not necessary to maintain maintenance logs or other information for magnifying glasses.

13.11 OVENS CHEMICAL PROCESSING):

There are commercially available electrical ovens designed for processing DFO enhanced evidence.

Maintenance: should be conducted in accordance with manufacturer's specifications.

13.12 BALANCES:

Maintenance/calibration of the scales should be in accordance with CLD policy. Balances will be calibrated at least once a year. All maintenance, calibrations, or verifications will be documented in the logbook for each specific balance.

13.13 DIGITAL IMAGE CALIBRATION TOOL CHECK:

Incorporated into the Digital Imaging system (DIS) is a software utility called the “Image Calibration Tool”. This utility resizes the captured image to bring it to an original 1:1 size. The resizing is not a critical measurement for Latent Print analysis, and discrepancies of 5% (1mm per 2 cm) are within tolerance.

The Image Calibration Tool utility will be checked (on the two DIS stations) following installation, significant upgrades, repair, and/or replacement utilizing the procedure below:

- Photograph a scale into the system
- Calibrate the image using the Image Calibration Utility
- Print the calibrated image at actual size (1:1)
- Compare the scale with the imaged/printed scale. If it appears the same, the check is complete
- If the imaged scale is out of tolerance with the original scale, place the scale calibration utility out of service
- When the check is completed, initial and date the print-out and retain with the Imaging system maintenance logs

13.14 CAMERAS:

Maintenance of the cameras should be in accordance with manufacturers’ recommendations

14.0 APPENDIX D – REAGENT SPECIFICATIONS

14.1 CONSUMABLES AND CHEMICALS

Latent reagents have no established purity or impurity threshold, therefore reagents will be laboratory reagent grade (sufficient for the technical analysis), or greater. Since most reagents purchased from specialty latent print supply vendors generally do not have a specified grade, reagents will be functionally tested. The positive functioning of a reagent when tested at its creation (if made on site) and again during a daily (or more frequent) evidence processing session, in conjunction with appropriate documentation, shall suffice for establishing that a reagent is of an appropriate grade. See CLD Quality Manual section 5.0.1.

The use of one's own sweat or sebum or the use of the commercial fingerprint reference pads will suffice for the positive check of latent print reagents. Use of other materials will require the documentation of the specific control. An untouched area of the test piece shall suffice for the negative control

Containers for chemical reagents and solvents should be kept tightly closed. All chemicals required for technical processing will be stored in accordance with applicable standards for that chemical. If appropriate, these chemicals will be marked with expiration dates. Disposal shall be in accordance with applicable standards.

Standard reference solutions and reagents prepared in the laboratory will be labeled properly with their identity, the date prepared, the initials of the person who prepared them, lot number, and safety precautions. The lot number for each reagent used in processing will be recorded in the case notes.

Consumable	Grade / or Approved Vendor1	Critical
Fingerprint powders	n/a	
Fingerprint lifting tape	n/a	
2-Propanol	Reagent grade	
Acid Yellow	Reagent grade	
Acetic Acid	Reagent grade	
Acetone	Reagent grade	
Acetonitrile	Reagent grade	
Ardrox P-133D	Fingerprint supply vendor	
Basic Yellow	Grade appropriate for fingerprint processing	
Citric Acid	Reagent grade	
Cyanoacrylate gels, liquids, wand cups	Fingerprint supply vendor	X
Cyclohexane	Reagent grade	
DFO	Reagent grade	X
Distilled water	Any	
Ethanol	Reagent grade	
Ethyl Acetate	Reagent grade	

[1] Where "Fingerprint supply vendor" is listed in lieu of a grade, the grade suitability for use will be verified by testing when reagent is made or used. See FLSB Quality manual 5.0.1.

Gentian violet (Crystal violet)	USP	
Glacial Acetic Acid	Reagent grade	
Heptane	Reagent grade	
HFE-7100	Industrial grade solvent	
Indandieone	Reagent grade	X
Industrial methylated spirit	Industrial grade solvent	
Iodine crystals (Iodine)	USP	
Isopropyl alcohol	Reagent grade	
Kodak Photo Flo 200 Solution	Kodak	
MBD	Reagent grade	
Methanol	Reagent grade	
Methylene chloride	Reagent grade	
Molybdenum disulphide	Grade appropriate for fingerprint processing	
Naphthol Blue Black (Amido)	Reagent grade	
Ninhydrin, monohydrate	Reagent grade	X
NinhydrinHT	Fingerprint supply vendor	X
Petroleum ether	Laboratory Reagent	
Physical Developer Part A and B	Fingerprint supply vendor	X
Rhodamine 6G	Grade appropriate for fingerprint processing	
Silver Nitrate	Reagent grade	X
Sudan Black B	Reagent grade	
TapeGlo™	Brand name	
WetWop™/Wet powder	Brand name or other rebranded Kjell Carlson innovation product	

15.0 APPENDIX E – REFERENCE INFORMATION

15.1 METRIC EQUIVALENTS

DRY		
1 pound (lb) 1 ounce (oz) 1 g 1 milligram (mg)	= = = =	453.6 grams (g) 28.35 g 0.035 oz 0.001 g
LIQUID		
1 milliliter (mL) (cc) 1 liter (L) 29.573 mL 500 mL 3.79 (L) 18.95 L 0.946 L	= = = = = = =	0.034 fluid oz 1000 mL 1 fluid oz 0.5 (1/2) L 1 gallon (gal) 5 gal 1 quart (qt)

15.2 CHEMICAL SYNONYMS

Acetone:

dimethylformaldehyde, dimethylketal, dimethyl ketone, beta-ketopropane, propanone, 2-propanone, pyroacetic ether, B-ketopropane

a-Naphthoflavone:

benzo(h)flavone, 7,8-benzoflavone, alpha-naphthoflavone, alpha-naphthylflavone, 2-phenyl-4h-naphtho, (1,2-B)pyran-4-one

Ardrox P-133D:

Tracer Tech P-133D

Citric Acid:

beta-hydroxytricarballylic acid, 2-hydroxy-1,2,3-propanetricarboxylic acid, citric acid monohydrate

Cyclohexane:

hexahydrobenzene, hexamethylene, hexanaphthene

Ethyl Ether:

ethylene glycol monomethyl ether, 2-methoxyethanol, methyl glycol, glycolmethyl ether, methoxyhydroxyethane

Ferrous Ammonium Sulfate:

ammonium ferrous sulfate, ammonium iron (II) sulfate, mohr's salt, ferrous ammonium sulfate hexahydrate

Gentian Violet:

crystal violet, aniline violet, crystal violet chloride, hexamethyl pararosaniline chloride, oxiuran, vermicid, hexamethyl-p-rosaniline chloride, hexamethyl-p-rosaniline hydrochloride, hexamethyl violet, methyl-rosaniline chloride, bismuth violet, gentiaverim, basic violet 3

Glacial Acetic Acid:

acetic acid, ethanoic acid, vinegar acid, ethylic acid, pyroligeneus acid, methanecarboxylic acid

HFE-7100:

Hydrofluoroether, 1-methoxy-nonafluorobutane

Isopropyl Alcohol:

isopropanol, 2-propanol

MBD:

[7-(Methoxybenzylamino\0-4\nitrobenz-2-oxa-1,3-Diazole]

Methanol:

methyl alcohol, carbinol, wood spirit, wood alcohol

Methylene Chloride:

aerothane MM, dichloromethane, methane dichloride, methylene bichloride, methylene chloride, methylene dichloride

Molybdenum disulphide:

(aka) Rocol A S Powder.

Naphthol Blue Black:

acidal black 10B, acidal navy blue 3BR, acid black 10A, 12B, 10BA, base M, 4BN, 4BNU, 10BN, BRX, BX, H, 1, or JVS, acid blue black B, 10B, BG, or double 600 (See MSDS for additional names)

n-Dodecylamine acetate:

alamine 4, amine BB, 1-aminododecane, armeen 12D, 1-Dodecanamine (9CI) 1-dodecylamine, kemamine P90, laurinamine, laurylamine, N-laurylamine, monododecylamine, nissan amine BB

Ninhydrin:

2,2-dhydroxy-1,3-indandione, indantrione, monohydrate, ninhydrin hydrate, triketohydrindene hydrate

Petroleum Ether:

petroleum spirits, petroleum naptha, benzine

Rhodamine 6G:

9-(2-(ethoxycarbonyl)phenyl)-3, 6-bis(ethylamino)-2, 7-dimethylxanthylium chloride, C.I. basic red I

Water-Based Fixative Solution:

5-sulphosalicylic acid in distilled H2O

15.3 ALS FILTER AND GOGGLE RECOMMENDATIONS

Wavelength of ALS	Recommended Filter and/or Goggles
< 400nm	Yellow or UV safe
400nm – 450nm	Yellow
450nm – 540nm	Orange
540nm – 700nm	Red

700nm – 1100nm	Red or IR

These are general recommendations and other combinations may result in better contrast especially at the extreme ends of each range where the chart shows overlap. In addition, other combinations, including not using filters, may provide better contrast when dealing with background fluorescence and analyst's discretion should be used in determining the best combination.

It is required that both the wavelength of the ALS and type of goggles and/or filters used be documented in case notes.

15.0 APPENDIX F – ABBREVIATION INDEX

15.1 ADMINISTRATIVE TERMS

CLD	Crime Laboratory Division
CSRT	Crime Scene Response Team
FLSB	Forensic Laboratory Services Bureau
FS	Forensic Scientist
LIMS	Laboratory Information Management System
P/EC	Property/Evidence Custodian
WSP	Washington State Patrol

15.2 AUTOMATED FINGERPRINT IDENTIFICATION SYSTEM (AFIS) TERMS

CAL-DOJ	California Department of Justice
CRD	Criminal Records Division
DIS	Digital Imaging System
DOB	Date of Birth
IAFIS	Integrated Automatic Fingerprint Identification System
Ident.	Identification Section
KC	King County
SID	State Identification Number
ULW	Universal Latent Workstation
WASIS	Washington State Identification Section
WIN	Western Identification Network

15.3 ANALYSIS/COMPARSION/EVALUATION TERMS

BQ	Better quality exemplars needed
CIR	Changed in review
CJE	Criminal Justice Employee
DisP	Distal Phalange
Elim.	Elimination
FP	Fingerprint
FJ	Finger joint
FRS	Friction Ridge Skin
FT	Fingertip
IC	Inconclusive
ID	Identification
Img.	Image
Imp.	Impression
IPA	Inner Pattern Area
LI	Left Index finger
LL	Left Little finger
LM	Left Middle finger
LR	Left Ring finger
LT	Left Thumb
L1 (L2, L3)	Level of Detail
MCP	Major case prints
MCPN	Major case prints needed
MedP	Medial Phalange
ND	Not determined/unknown

Neg.	Negative
NSA	Not suitable for AFIS search
NV	No value
OV	Of value
P	Palm
PP	Palm print
ProxP	Proximal Phalange
Reg	Registered to unidentified latent database
RD	Ridge detail
RI	Right Index finger
RL	Right Little finger
RM	Right Middle finger
RR	Right Ring finger
RT	Right Thumb
Sus.	Suspect
T/J/S	Tips, joints, sides of fingers
Unk.	Unknown
Vic.	Victim

15.4 EVIDENCE PACKAGE DESCRIPTIONS

GSPB	Glue-sealed plastic bag
HSPB	Heat-sealed plastic bag
SAIR	Sealed air-dry bag
SBOX	Sealed box
SCAN	Sealed can
SE	Sealed Envelope
SGUN	Sealed gun box
SPB	Sealed Plastic Bag
SPKG	Sealed package
SPPB	Sealed paper bag
SRIF	Sealed rifle box
SSTYRO	Sealed Styrofoam box

RFLE	Request for Laboratory Examination

15.5 PROCESSING TECHNIQUES

AB	Amido Black
ALS/FLS	Alternate/Forensic Light Source
Ax	Ardrox
AY	Acid Yellow
BY	Basic Yellow
CA	Cyanoacrylate
DFO	1,8-Diazafluoren-9-One
GB	Gun Blue
GV	Gentian Violet
HH	Heat and humidity
IND	1,2-Indanedione
MBD	P-Methoxybenzlamino-4Nitrobenz-2-Oxa-1,3-Diazile
NIN	Ninhydrin
NIN HT	Ninhydrin HT
P	Powder
PD	Physical Developer
RAM	Rhodamine-Ardrox-MBD

R6G	Rhodamine 6G
SPR	Small Particle Reagent
SS	Sticky Side Powder
TG	TapeGlo™
VIS	Visual examination
WW	Wetwop™
ZC	Zinc Chloride

Powder Modifiers:

B – Black
FL – Fluorescent
M – Magnetic
W – White
BI – Bichromatic

15.6 PROCESSING TERMS

NAO	No additional ridge detail observed
NRD	No ridge detail present
RD-NV	Ridge detail - no value

15.7 FINGERPRINT PATTERN TYPES

A	Arch
A-T	Tented Arch
A-P	Plain Arch
L	Left Slant Loop
R	Right Slant Loop
W	Whorl
W-A	Accidental Whorl
W-CP	Central Pocket Loop Whorl
W-DL	Double Loop Whorl
W-P	Plain Whorl

16.0 APPENDIX G – LATENT PRINTS TECHNICAL MANUAL HISTORY

LATENT PRINTS TECHNICAL MANUAL HISTORY		
ISSUING AUTHORITY: QUALITY ASSURANCE MANAGER		
SECTION AND COMMENTS	DATE	AUTHOR/REVIEWER
Current Manual – Latent Print Current Procedures 2005		
09-001 Major Revision – considered new, original manual	March 3, 2009	Watson/Neilson
09-002 (Rev 1) 7.0.2.1 – Documentation of analysis 9.0.5.7 – Registered Latents	July 10, 2009	Auman/Neilson
09-003 (Rev. 2) Appendix G – added abbreviations	August, 2009	Arwine/Luthy/Neilson
2010 Annual Manual Review	October 6, 2010	Watson
Revision 3 December 20, 2010 • Chapter 6 – Digital Imaging • Revision 3 – Clean Manual	December 20, 2010	Redhead/Watson
2011 Annual Review – includes both Technical and Training Manuals	December 23, 2011	Brannan
Revision 4 May 7, 2013 • Remove Appendix F, to create new LPL Training Manual	May 7, 2013	Brannan/Watson/Neilson
Revision 5 November 1, 2013 • Changes to Section 3 – Terms and Definitions • Changes to 7.023 and 7.024 – Up to current practice	November 1, 2013	Brannan/Watson
Revision 6 March 4, 2014 • Delete Section 8.0.2 – Reporting Criteria	March 4, 2014	Brannan/Watson

• Revise Balance Calibration – Appendix C		
Revision 7 October 28, 2014 • Add Procedures for Oil Red O November 26, 2014 • Rewrite Chapter 7 February 10, 2015 • IBIS replaced by ABIS, manual changed to reflect	 October 28, 2014 November 26, 2014 February 10, 2015	 Redhead/Luthy Brannan/Watson Luthy/Brannan/Watson
2014 Manual Review – Latent Prints Technical Procedures	December 29, 2014	Trejo/Watson

17.0 APPENDIX H – LATENT PRINT WORKSHEETS & FORMS